US Army Corps
of Engineers
Water Resources Support Center
Institute for Water Resources

National Economic Development Procedures Manual - Recreation

Volume III

A Case Study Application of Contingent Value Method for Estimating Urban Recreation Use and Benefits

November 1990

IWR Report 90-R-11

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188
Exp Date Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) IWR Report 90-R-11	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Water Resources Support Center Institute for Water Resources 6b. OFFICE SYMBOL (*If applicable*) CEWRC-IWR	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (*City, State, and ZIP Code*) Casey Building Fort Belvoir, VA 22060-5586	7b. ADDRESS (*City, State, and ZIP Code*)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION U.S. Army Corps of Engineers 8b. OFFICE SYMBOL (*If applicable*) CECW-PD	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (*City, State, and ZIP Code*) Washington, DC 20314-1000	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO

11. TITLE (*Include Security Classification*)
National Economic Development Procedures Manual-Recreation Volume III: A Case Study Application of the Contingent Value Method for Estimating Urban Recreation Use and Benefits

12. PERSONAL AUTHOR(S) William J. Hansen, Allan S. Mills, John R. Stoll, Roger L. Freeman, and Carol D. Hankamer

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (*Year, Month, Day*)	15. PAGE COUNT
	FROM _____ TO _____	90/11/30	117

16. SUPPLEMENTARY NOTATION

22161

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA

17. COSATI CODES			18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)
FIELD	GROUP	SUB-GROUP	Recreation, Demand, Planning, National Economic Development Benefits Contingent Valuation Method, Value Estimating Models

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

The purpose of this report is to illustrate, through a case study description, the practical application of the CVM method to recreation evaluation in an actual planning study. The case study description is meant to serve as a practical guide and, therefore, emphasizes what was done more than the concepts behind the techniques used. It is not intended to be a detailed guide of the entire planning process, but rather highlights activities or outcomes from this process that involved the development, conduct, and application of the CVM analysis. Specific objectives of this manual are: to illustrate an urban application of the CVM method to recreation demand and benefit estimation, to illustrate the development of regional valuation models, and to describe the potential transferability of the procedures and/or findings of this case study to other planning applications.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL WILLIAM J. HANSEN	22b TELEPHONE (*Include Area Code*) (703) 355-3089 22c OFFICE SYMBOL CEWRC-IWR-R

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

NATIONAL ECONOMIC DEVELOPMENT PROCEDURES MANUAL - RECREATION

Volume III

A Case Study Application of the Contingent Valuation Method for Estimating Urban Recreation Use and Benefits

by

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November, 1990

IWR Report 90-R-11

PREFACE

The work reported herein was conducted as part of the National Economic Development (NED) Procedures Manual Work Unit within the US Army Corps of Engineers (COE) Planning Methodologies Research Program. Mr. William Hansen of the COE Water Resources Support Center (WRSC), Institute for Water Resources (IWR), manages this Work Unit under the general supervision of Mr. Michael Krouse, Chief of the Research Division, Mr. Kyle Schilling, Director of IWR, and Mr. Kenneth Murdock, Director of WRSC. Mr. Robert Daniel (CECW-PD) is the Technical Monitor for Headquarters, US Army Corps of Engineers.

The data collection and analysis that provide the basis for this case study were conducted as part of the Buffalo Bayou recreation evaluation component of the COE Galveston District's Buffalo Bayou and Tributaries Flood Control Study. Mr. Roger Freeman, of the Galveston District was co-project manager and responsible for the economic and social aspects of that study, including the recreation evaluation.

The original work on the Buffalo Bayou recreation evaluation, as well as much of the work of preparing this manual, was performed under the terms of a cooperative agreement between the COE Galveston District, the National Park Service (NPS) Southwest Regional Office, and through a NPS Cooperative Park Studies Unit (CPSU) at Texas A&M University. Dr. Dennis Fenn, currently Unit Leader of the NPS CPSU at the University of Arizona, was the Unit Leader at Texas A&M University during the initiation of this cooperative effort and was instrumental in its development. Dr. John Stoll, Department of Agricultural Economics, and Dr. Allan Mills, then with the Department of Recreation and Parks, Texas A&M University served as co-Principal Investigators for the initial Buffalo Bayou recreation evaluation.

Upon completion of the original study, Mr. William Hansen at IWR assembled a five person team of cooperators to produce this manual. Through a modification to the original cooperative agreement, Dr. Stoll served as Principal Investigator for this team effort. Dr. Mills, presently with the Department of Recreation, Parks and Tourism, Virginia Commonwealth University, was a team cooperator under terms of an Intergovernmental Personnel Act Agreement with IWR. Roger Freeman and Carol Hankamer of the Galveston District Office were also team cooperators.

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INTRODUCTION

BACKGROUND

This is the third in a series of manuals written to provide an expanded description of the recreation evaluation procedures recommended in the US Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, (P&G). Volumes I and II of the three part manual series were published in March of 1986. Volume I, "Recreation Use and Benefit Estimation Techniques," summarizes the conceptual basis of procedures for recreation valuation associated with water and related land resources planning. It describes the mechanics of acceptable valuation methods and offers criteria for determining the applicability of various methods to particular planning situations. Volume II, "A Guide for Using the Contingent Value Methodology in Recreation Studies," provides additional information on the basic concepts of the Contingent Value Method (CVM), as well as detailed guidance for its application.

The intent of the first two volumes was to provide general, state of the art guidance to the field on alternative recreation use and benefit estimation techniques. As a result, examples of the "how to" and "what to do, if" when facing the vagaries of an actual field application were limited. In addition, especially in Volume I, many of the examples used to illustrate the techniques were dated and limited to lake recreation applications.

This third volume of the recreation manual series was written to document an application of the CVM method for evaluating the demand for urban recreation facilities. The Galveston District of the US Army Corps of Engineers applied the CVM method to the estimation of recreation benefits associated with its Buffalo Bayou Flood Control Study in Houston, Texas. In addition to this study being a unique application of the CVM method, the CVM data were collected so that regional use estimation and valuation models could be developed.

PURPOSE AND SCOPE

The purpose of this report is to illustrate, through a case study description, the practical application of the CVM method to recreation evaluation in an actual planning study. The case study description is meant to serve as a practical guide and, therefore, emphasizes what was done more than the concepts behind the techniques used. It is not intended to be a detailed guide of the entire planning process, but rather highlights activities or outcomes from this process that involved the development, conduct, and application of the CVM analysis.

Specific objectives of this manual are: to illustrate an urban application of the CVM method to recreation demand and benefit estimation, to illustrate the development of regional valuation models, and to describe the potential transferability of the procedures and/or findings of this case study to other planning applications. A brief description of the remaining chapters follows.

Chapters II through V describe the general tasks that were accomplished in developing urban recreation use and value estimates for the Buffalo Bayou Flood Control Study. These tasks include: Identifying Study Objectives and Constraints (Chapter II), Questionnaire Design (Chapter III), Sample Design and Survey Administration (Chapter IV), and Analysis and Benefit Evaluation (Chapter V). Each of these chapters begins with a brief discussion of concepts and objectives and, what could be considered, a preferred approach for accomplishing that particular task. This is followed by a summary of what was actually done in the Buffalo Bayou Study, including a discussion of how the preferred approach was modified to accommodate study constraints. A brief discussion of lessons learned from the Buffalo Bayou case study is then presented. Most chapters conclude with a selected list of useful annotated references.

The development of regional value estimation models is discussed in Chapter VI, Regional Models. This chapter begins with a discussion of some of the history and objectives of regional modeling. The Buffalo Bayou application is then described, including a discussion of model results. Lessons learned and recommendations for future modelling efforts are then presented. The chapter concludes with a selected list of useful annotated references.

The last chapter of the manual, Chapter VII, "Further Applications," addresses the transferability of the procedures and findings of the Buffalo Bayou Study to other planning studies. Several appendices are included to supplement the materials presented in the main text.

CHAPTER II
STUDY OBJECTIVES AND CONSTRAINTS

As with other planning studies, it is very important in a contingent value analysis that study objectives be clearly defined, and that the necessary resources (primarily funding, personnel, and time) to accomplish the work be identified. Delineation of study objectives will help identify data needs as well as the population from which information might be required. When combined with study resource constraints, these objectives help determine whether or not a contingent valuation survey is needed or can be used to obtain needed information, and, if so, what is the most efficient and effective survey approach for the particular problem being analyzed.

CONCEPTS AND OBJECTIVES

DEFINE PROBLEM

As described in the P&G, the planning process consists of the following steps: specifying the water and related land resource problems and opportunities; inventorying, forecasting, and analyzing water and related land resource conditions within the planning area; formulating alternative plans; evaluating the effects of the alternative plans; comparing alternative plans and selecting a recommended plan. The primary goal of a CVM analysis is to provide an estimate of the NED benefits of alternative recreation plans. These benefit estimates are primarily used in the latter steps of evaluating and comparing alternatives and selecting a recommended plan.

Early in the planning process, the CVM analyst and/or recreation planner needs to work closely with other members of the project study team to formulate alternative plans and to develop descriptions of the with- and without-project conditions for each plan. The objective of the Corps recreation program is to fully consider the recreation potential that may be provided at Corps Civil Works projects. Formulated plans should, therefore, be responsive to public needs and opportunities while recognizing the limitations of the project resources, both natural and man-made, for recreation development. Plan formulation should be coordinated with other federal, state, and local recreation planning agencies, and the resulting plans should be consistent with public needs identified in State Comprehensive Outdoor Recreation Plans.

Clear delineation of the with- and without-project condition for each of the formulated plans is needed to define the evaluation problem to be addressed. It will also provide insight as to the most appropriate valuation technique to be used. As noted in Chapter I, criteria for determining the applicability of the various recreation valuation techniques to particular planning situations are provided in Volume I of this NED Procedures Manual - Recreation series.

INFORMATION NEEDS

The process of formulating alternative plans and describing with- and without-project conditions will begin to identify information needs for plan evaluation. Obviously, one of the primary objectives of the evaluation of alternatives is to estimate the amount and value of recreation use that would occur under each of the with- and without-project conditions. If a survey is to be used to collect this information, then consideration should be given to other types of planning information (e.g., activity or facility preferences) that could also be collected to support the ongoing or future planning studies. Before a decision is made to conduct a survey however, existing literature and information sources should be reviewed to determine whether or not the needed information is already available and, if not, whether or not a CVM survey is the most efficient and effective means of collecting the needed information.

As noted in the P&G, one of the first steps in selecting a recreation valuation procedure is to determine whether or not an applicable regional model is available. If one is available, it should generally be used. Usually it will only require information readily available from secondary data sources. If an applicable regional model is not available, then recreation management agencies, universities and other research institutions should be contacted. They may have data available from which use estimating and valuation models can be developed. If not, a survey may be necessary to collect needed data. The CVM technique is often the most appropriate method for collecting this information. A new CVM survey should only be considered, however, when existing data are not available to evaluate the plans being considered.

RESOURCE CONSTRAINTS

Study resources that can be devoted to the evaluation are important considerations, not only in the selection of an optimal valuation procedure or benefit estimation technique, but also in how the study is conducted. The amount of time that can be devoted to the recreation evaluation is always an important resource constraint. If the CVM benefit estimation technique is selected, some type of survey will be needed. If an on-site survey is used, then sufficient study time is needed to select and collect data from a representative sample from the appropriate recreation season(s). Similarly, if a household survey is used, time is needed for conducting the survey and for possible follow-up contacts with non-respondents. The amount of time available in the overall study can sometimes preclude certain valuation procedures or benefit estimation techniques from being considered.

Another important resource constraint is the amount of study funds that can be allocated to the recreation evaluation. An important consideration is not only the total funding available, but how the total is allocated to the various steps required in the evaluation. Often too much of the funding is devoted to data

collection with insufficient funding for data analysis. In defining the problem and developing specific evaluation objectives, the analyst needs to be sure adequate funding is allocated throughout the evaluation process so that the final product is in a form that can support the overall planning effort.

A final resource constraint that must be considered when determining how the study objectives are to be accomplished is the availability of in-house personnel and expertise. The development of a CVM analysis will sometimes require expertise in questionnaire design, survey sampling, and/or survey analysis that is not available in district offices. Cooperative agreements with other agencies or contracting can make this expertise available to Corps district staffs. However, institutional constraints and the additional time needed to implement cooperative or contracting arrangements must be considered in selecting the optimal approach for each particular planning application.

DEVELOP SPECIFIC OBJECTIVES

If, based on information needs and resources constraints, a decision is made to proceed with a CVM study, specific objectives for the survey and analysis should be developed. The objectives should identify the information needs, both those specifically required for the recreation evaluation, as well as secondary information that could be efficiently collected to support other planning activities. Both the resource constraints under which the analysis is to be conducted and the general survey approach to be used should be specified. The importance to this process of clearly describing with- and without-project conditions for all formulated plans cannot be overemphasized.

WHAT WAS DONE

The Buffalo Bayou study area is primarily located in Harris County and portions of Ft. Bend and Waller Counties, in southeastern Texas (Figure 1). Buffalo Bayou and its tributaries drain a 1,034 square mile area which includes most of the Houston metropolitan area. Nearly two million people currently reside in the Buffalo Bayou watershed. The study region is located in flat coastal plains. For study purposes the area has been divided into ten sub-areas (Figure 2).

Historically, frequent flooding has occurred in the Buffalo Bayou area. A comprehensive study conducted by the Galveston District was directed toward alleviating this flood problem, with both structural and non-structural flood damage reduction plans being considered. In the comprehensive study, the investigation also addressed other water resource problems and needs in the area, including recreation. When certain conditions are met, recreation facilities can be an incremental addition to local flood control projects.

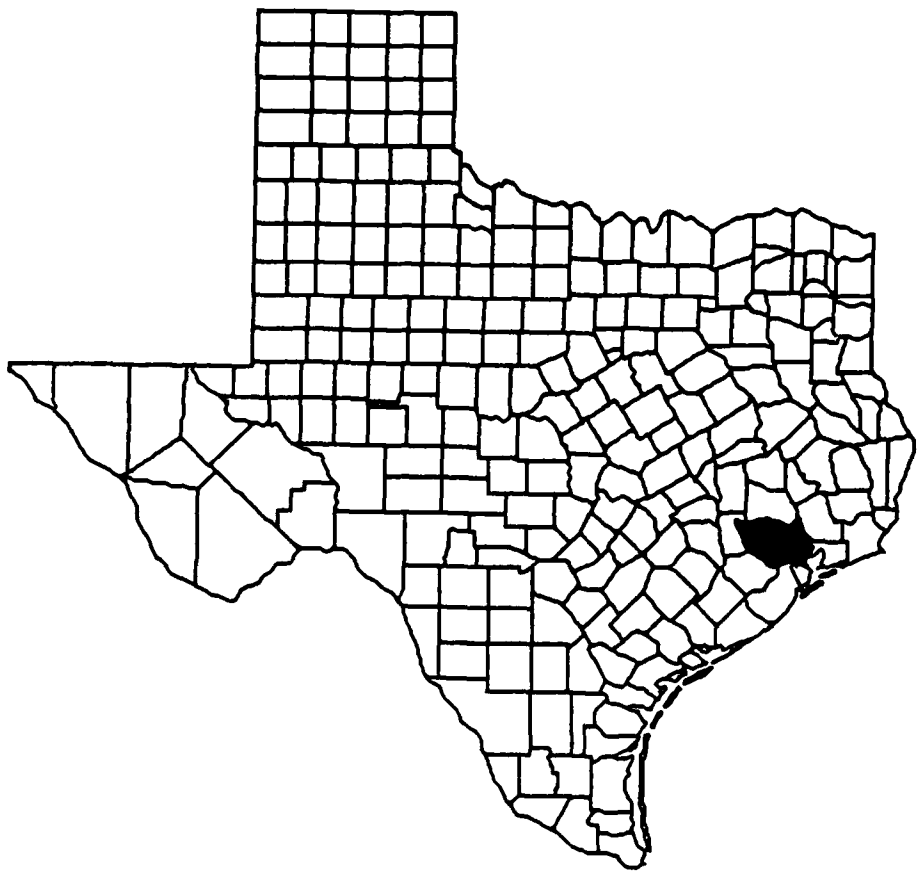

Figure 1. Study Region within the State of Texas

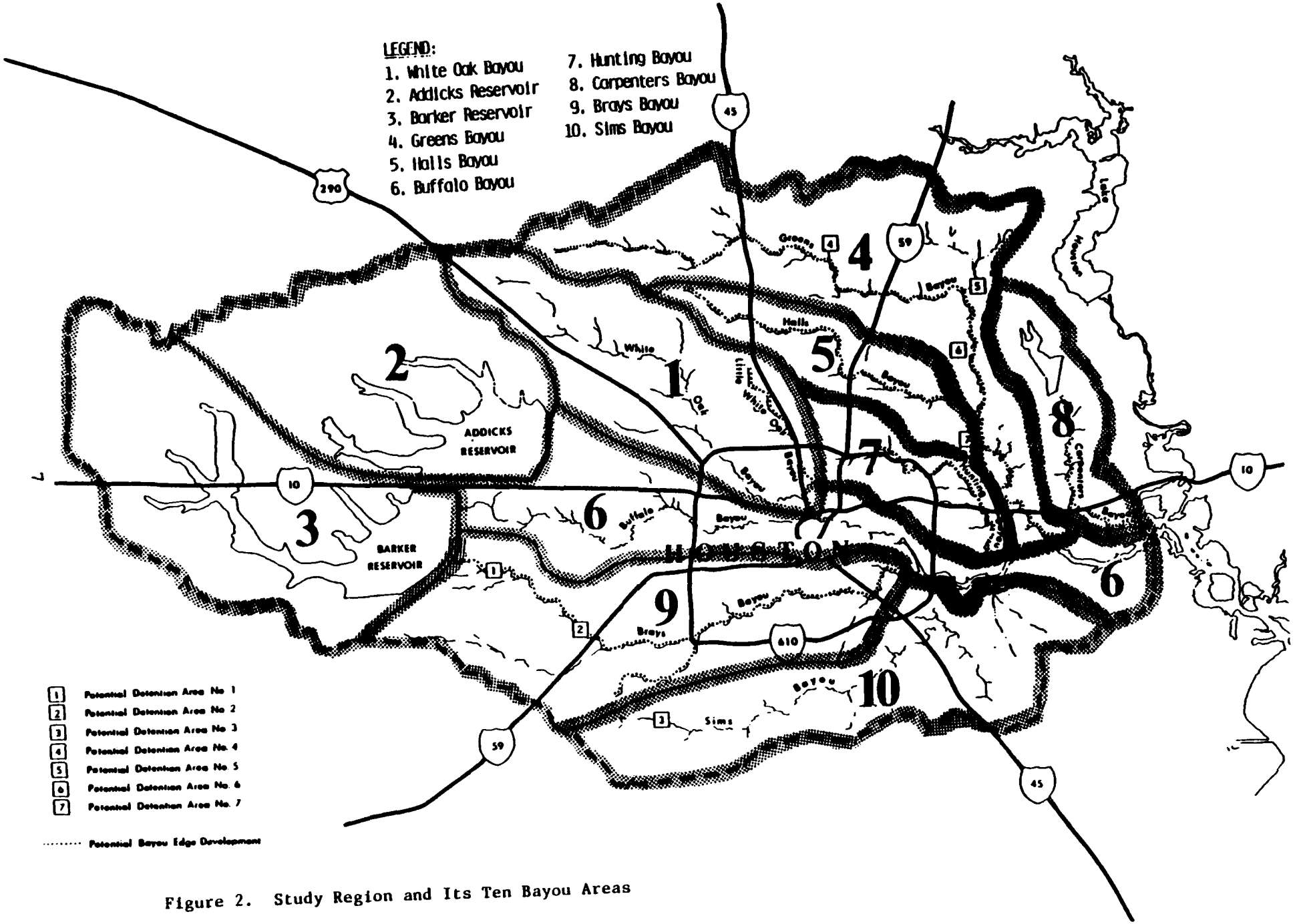

Figure 2. Study Region and Its Ten Bayou Areas

For structural plans these conditions include: the recreational facilities do not increase the overall costs by more than 10 percent; the separable costs of the recreation facilities must be incrementally justified; benefits from the recreational facilities may not be used to justify the structural flood prevention measures; and a non-Federal entity must be willing to provide 50 percent of the separable cost for construction and 100 percent of the operation and maintenance cost for the recreation facilities. For non-structural flood control plans there is no limit on the percentage cost increase for the recreational facilities, and the recreation benefits can be used in the justification of the non-structural flood control features.

IDENTIFICATION OF PLANS

Early in the study process, meetings of the Corps planning team, including the study manager, project designers, economists, and recreation planners were held. The objectives of these early meetings were to identify the primary flood control alternatives that were being considered, the types of recreational facilities that could be logically incorporated into these plans, and the constraints, primarily time and money, under which the evaluation of the recreation facilities would need to be conducted. A comprehensive flood damage reduction plan was formulated for the Buffalo Bayou Watershed which included 75.3 miles of stream enlargements, 7 flood detention basins, and other features. In addition, environmental features, consisting of revegetation on project lands, would compensate for fish and wildlife habitat losses.

Conceptual recreational plans that could be incorporated into this comprehensive flood damage reduction plan were also identified. The proposed facilities consisted primarily of multipurpose trails, picnic sites, open areas for field sports, and play areas along stream rights-of-way and in proposed detention areas. Some of these were similar to existing facilities that had been developed by local park departments in other areas within the Houston metropolitan region.

Contacts with other recreation agencies were also made early in this study to identify existing data sources and to coordinate the formulation of recreation plans. Extensive data were available on the number and location of existing facilities, but little information was available on the use of specific facilities. According to City of Houston and State of Texas agencies, a great diversity of recreational facilities is available in the study region, but a substantial deficiency of developed recreation lands persists in the urban areas.

The 1985 Texas Outdoor Recreation Plan (TORP), identifies recreation resource needs for 1985 through 1995 for State Planning Region 16, which is coincident with the Buffalo Bayou Study Area. Additional facilities are needed to accommodate such activities as:

swimming, boating, baseball, football, basketball, soccer, bicycling, jogging, hiking and walking, fishing, tennis and picnicking. Many of these activities could be supported by the types of facilities being considered in the Buffalo Bayou Study.

The land made available by the proposed flood damage reduction projects provides an opportunity to satisfy a portion of these recreation needs without affecting the functioning or increasing the maintenance costs of the flood control projects. Such facilities would complement the proposed projects. Based on the types of facilities that could be accommodated with the proposed flood protection plans, the needs of the Houston area, and other planning constraints, a potential facility plan was developed (Table 1).

IDENTIFY STUDY OBJECTIVES

Based upon the early meetings of the Corps planning team, a set of objectives was formulated for the recreation evaluation study. An initial objective was to identify the set of potential recreation facility developments which could be provided in the Houston study area.

Primary Objectives. There were three primary study objectives:

- To estimate the annual use of alternative recreation facility developments being considered for implementation.
- To estimate the typical resident's annual economic value for the recreation facility developments being considered for implementation, and influences of socio-economic characteristics on this value.
- To estimate the total (aggregate) annual economic value for the recreation facility developments being considered for implementation.

The above objectives indicate the types of data necessary to determine the potential use and incremental values of the potential recreational facility developments for the flood control plans. Later chapters of this manual document how contingent valuation techniques were used to obtain data for addressing these objectives.

Secondary Objective. The following study objective was defined to indicate secondary data needs for the recreational component of the flood control plans:

- To identify Houston residents' preferences for recreational settings, facilities, activities, and experiences within the Buffalo Bayou and Tributaries region.

Table 1. Preliminary Recreation Facility Plan

Category	Carpenters Bayou	Greens Bayou	Halls Bayou	Hunting Bayou	Little White Oak Bayou	Brays Bayou	Sims Bayou	Total
Bayou Edge Developments:								
Miles of Multipurpose Trails	1.3	10.3	13.0	1.2	1.0	6.8		33.6
Miles of Picnic Tables and Cooking Grills	6.0	40.0	30.0	16.0	10.0	20.0		122.2
Inclusion of Trail Side Benches	2.0	6.0	8.0	4.0	4.0	12.0		36.0
Inclusion of Canoe/Boat Launching Ramp		1.0						5.0
Inclusion at Additional Paved Access Roadway		Yes						
Provision at Additional Parking Areas		Yes						
Number of Boat Launching Ramps			1.0					1.0
Provision of Exercise Stations			2.0					2.0
Number of Parking Areas with Access Roads			1.0	1.0				2.0
Number of Restrooms			1.0	1.0				2.0
Number of Drinking Fountains			2.0	2.0				4.0
Detention Areas:								
Number of Flood Detention Basins		4.0				2.0	1.0	7.0
Number of Picnic Tables and Grills		160.0				140.0	80.0	380.0
Number of Pavilions		5.0				5.0	2.0	12.0
Number of Playgrounds		5.0						7.0
Number of Sports Fields		22.0						22.0
Number of Benches		6.0						6.0
Number of Parking Areas with Access Roads		5.0				3.0	1.0	9.0
Number of Restrooms		4.0				3.0	1.0	8.0
Number of Drinking Fountains		8.0				6.0	2.0	8.0

The identification of recreation setting preferences was needed to compare potential use and value differences for those Houston residents who prefer developed versus more natural settings. Preferences for different types of specific recreational facilities, activities, and experiences or motivation outcomes were defined as important ancillary data for application later in the planning process, as well as for use in subsequent urban recreation planning studies.

WHAT WAS LEARNED

It was learned that recreational studies of this kind should be fielded (implemented) as early in the comprehensive planning process as possible. Time must be provided to clearly define the study problem. This definition stage of the CVM survey and recreational study must include time for contacts with known experts, both from within and outside the COE and should allow for the involvement of various levels of COE management. This is critical to have the recreation study accepted and understood. If the planning process is to be maintained on schedule, the manager also needs to identify needed expertise early and to determine whether or not the recreation study team will be entirely from within the COE.

It was also learned that obtaining appropriate data from secondary sources is a difficult task. Secondary sources of data often will not provide necessary information for accomplishing the full objectives of a recreational study. Data from the 1985 TORP were good for establishing Region 16 as the highest outdoor recreation deficit area in the State of Texas. However, tne TORP did not provide sufficient information to evaluate the benefits of additional recreation facilities. Estimates of use for other similar, existing recreational facilities would also have been helpful but were not available.

ANNOTATED REFERENCES

1. US Water Resource's Council (1983) Economic and Environmental Principles and Guidelines for Water and Related Land Resources Studies, U.S. Government Printing Office, Washington, D.C.

   The Principles and Guidelines are intended to ensure proper and consistent planning by Federal agencies in the formulation and evaluation of water and related land resources implementation studies. The Federal objective and the water resources planning process are summarized in Chapter I, Standards. Chapter II describes the general National Economic Development (NED) procedures that are to be used, as well as providing specific guidelines for each of the water resource development outputs. Section VIII of Chapter II summarizes the NED evaluation procedures for recreation.

2. US Army Corps of Engineers (1985), Water Resource Policies and Authorities, Recreation Planning, Development, and Management Policies, Engineer Regulation 1165-2-400, Washington, D.C.

   This regulation defines the objectives, philosophies and basic policies for the planning, development and management of outdoor recreation and enhancement of fish and wildlife resources at Corps of Engineers water resource development projects. Appendix B provides a checklist of the types of new facilities which may be provided in recreation developments at Corps water resource projects. Included in this checklist is the appropriate percentage of the costs of such facilities that should normally be provided by non-Federal interests. Copies of the regulation are normally maintained in Corps district or division regulation libraries.

3. Sassone, Peter G. and William A. Schaffer (1978) Cost-Benefit Analysis: A Handbook, Academic Press, Inc., New York.

   This is an excellent text describing cost-benefit analysis for the non-economist. Basic principles, logic, and methods are described in a clear manner. More complicated procedures are discussed and illustrated graphically. One noteworthy feature is the focus on presenting results in a manner which is easily understood, making project analyses more useful in the decision-making process.

4. Leedy, Paul D. (1985) Practical Research Planning and Design, Macmillan Publishing Company, New York.

   Chapter 3 of this book, "The Problem: Heart of the Research Project," is recommend reading for how to approach defining the research problem for a study. The section entitled "The Statement of the Problem" is particularly good for someone who has never had to define a research problem in writing.

CHAPTER III
QUESTIONNAIRE DESIGN

CONCEPTS AND OBJECTIVES

Every study is unique in some way. It is therefore usually necessary to design a new survey questionnaire for each new contingent valuation (CVM) study. This is the case even when the same questions are used, because some special adaptations of the survey questions are usually necessary to fit each survey situation. The way in which questions are worded, as well as how questions are formatted and placed in the questionnaire are a function of many factors. There are, however, some commonalities that ideal questionnaire designs share across most CVM studies. Good questionnaire designs provide for efficient and effective collection of valid and reliable data needed to adequately address study objectives.

CATEGORIZATION OF INFORMATION NEEDED

The first step in designing a CVM questionnaire is to develop an initial list of questions which correspond to each category of needed information, dictated by the study objectives. At least three categories of questions usually emerge: 1) ancillary behavioral and/or attitudinal questions (e.g., participation and preferences), 2) contingent valuation questions, and 3) socio-demographic questions for profiling sample respondents.

SELECTING APPROPRIATE TYPE OF SURVEY

Simultaneous with the development of the questionnaire, a decision must be made as to which type of survey will be best for the study. This decision is usually based upon general information needs, the potential population of interest, and study constraints.

A survey may either be administered with personal interviews (face-to-face or by telephone), or designed as a self-administered questionnaire (usually sent by mail). Some of the most useful decision criteria with respect to survey information needs and constraints are given in Table 2. Some of these criteria are more important than others for CVM studies, particularly complex CVM studies of urban area residents to value proposed recreational developments. As summarized in Table 2, there are strengths and weaknesses associated with each type of survey.

Table 2. Selected Comparisons of Face-to-Face and Telephone Interviews and Mail Questionnaires

Performance Characteristics	Face-to-Face Interviews	Mail Questionnaires	Telephone Interviews
I. Likelihood of avoiding unknown bias from refusals.	High	Low	High
II. Questionnaire construction and question design.			
A. Allowable question complexity.	High	Medium	Low
B. Success with open-ended questions.	High	Low	High
C. Success with controlling sequence.	High	Low	High
D. Success with tedious or boring questions.	High	Low	Medium
E. Insensitivity to questionnaire construction procedures.	High	Low	Medium
III. Obtaining accurate answers.			
A. Likelihood that social desirability bias can be avoided.	Low	High	Medium
B. Likelihood that interviewer distortion and subversion can be avoided.	Low	High	Medium

Table 2, Continued.

Performance Characteristics	Face-to-Face Interviews	Mail Questionnaires	Telephone Interviews
IV. Administration requirements.			
A. Likelihood that personnel requirements can be met.	Low	High	High
B. Potential speed of implementation.	Low	Low	High
C. Keeping costs low.			
1. Overall potential for low per interview costs.	Low	High	Medium
2. Insensitivity of costs to increasing geographical dispersion.	Low	High	Medium

(Source: Mail and Telephone Surveys. by Don A.Dillman:pp.74-75.)

Face-to-face interviews rate highest for complex questions such as those with CVM scenarios and questions about future recreation developments and their use. In a face-to-face situation, the interviewer can show photos or drawings of the potential developments, and can give detailed answers to questions about what is being described. Mail questionnaires rate second best because the photos or drawings can be mailed with the questionnaire, but no interviewer can be present to answer respondents' questions about them. Telephone interviews rate lowest for complex CVM scenarios because it can be difficult to explain complex scenarios over the telephone without visual aids.

Success with open-ended questions is low by mail as compared with telephone or face-to-face personal interviews. This is because in a personal interview the interviewer does the work of writing down the open-ended responses. These can be lengthy at times, and it is tiring to those receiving mail questionnaires to write answers to many open-ended questions. The number of these kinds of questions should therefore be kept to a minimum for mail surveys. When the open-ended response requested is just a number, such as a dollar amount in response to a CVM scenario, not as much writing is required and response by mail can be quite good, provided the number of such questions is not too great.

Control over the sequence in which respondents answer questions is low by mail, as compared with high for telephone or face-to-face personal interviews. When an interviewer is present, he or she controls the sequence in which the questions and supporting material in the questionnaire are read. By mail there is no way of knowing if the interviewee reads the questions and supporting material in the order that they are printed in the questionnaire. With mail CVM questionnaires it is possible that some respondents may not read the scenario before answering a willingness-to-pay question.

Success with tedious or boring questions is best with face-to-face interviews, second best with telephone interviews, and lowest with mail questionnaires. Particularly long explanations or CVM scenarios that may be perceived as boring by respondents can be made more interesting when read by an interviewer. This is especially true when the interviewer maintains eye contact with the interviewee so as to pick up non-verbal cues when respondents begin to lose interest.

Mail questionnaires are the most sensitive to the need for high quality questionnaire design. The appearance of the questionnaire and the ease with which the questions can be read and answered are factors critical to inducing high response rates with mail questionnaires. In contrast, respondents to personal interviews often never see the questionnaire because the interviewer usually reads the questions to them. Therefore questionnaire appearance and construction is not as important.

With personal interviews, however, poor questionnaire construction does put an added burden upon the interviewer.

Mail questionnaires rate highest for avoiding social desirability bias. This is the natural human tendency to give socially acceptable answers to questions asked in the presence of others. Personal interviews rate low in this regard because an interviewer is present and the respondent generally is asked to verbalize some answers which could be perceived as socially unacceptable. An example would be a willingness to pay a very large dollar amount to support recreation facilities, but reluctance to say this in the interviewer's presence for fear that it would appear to be an abnormally high amount.

Mail questionnaires also rate highest for avoiding interviewer distortion and subversion, because no interviewer is present. Personal interview surveys can guard against this by good interviewer training, but it can still happen with some interviews. There is less chance of it happening by telephone than face-to-face, because less influence can be exerted by the interviewer by phone than when able to make eye contact with respondents in a face-to-face situation.

Face-to-face surveys generally require hiring and supervising more personnel for longer periods of time than mail or telephone surveys. When large numbers of interviewers are hired for telephone surveys, it is usually for shorter periods of time. Telephone interviewers are also easier to supervise, because there is no need to travel to interview sites. Interviewers are usually in one interview room with telephones rather than at field locations. Mail surveys require fewer personnel because interviewers are not needed.

Speed of implementation is generally highest for telephone surveys. The exception is when the survey sample is very large and telephone survey equipment is limited in quantity. Both face-to-face and mail surveys rate low on speed of implementation.

Mail surveys rate highest for keeping costs low, telephone surveys rate second highest, and face-to-face surveys rate lowest. This is largely due to the fact that interviewers do not need to be hired for mail surveys, and transportation to field interview sites is not necessary as with face-to-face surveys.

Resource constraints and/or study needs may preclude one type of survey and cause the CVM analyst to choose another. Cost is one such factor that often precludes face-to-face interviews. Time and the number of personnel available to work on a particular study are also often scarce resources. Some types of CVM scenarios may also require that respondents be given considerable time to reflect on the hypothetical situation posed by a CVM question. Personnel limitations can also dictate the type of survey to use. In some

cases, only one person is needed to design and carry out a mail survey. In contrast, interviewers must be trained and supervised to successfully conduct a face-to-face or telephone interview survey.

It should also be noted that for some studies it may be most effective to use some combination of survey techniques. For example, a face-to-face on site contact with a follow-up mail-back survey, or pre-mailing of a questionnaire or graphic materials with a follow-up telephone interview are effective techniques for increasing survey efficiency and effectiveness and survey response.

IDENTIFYING EFFECTIVE QUESTION FORMAT

After selecting the appropriate survey method, the next step is to identify the most effective type of question format for each question. This is done with respect to both the particular types of questions to be asked and the way in which the survey will be administered. It is a subjective process that is more art than science. The most logical way to begin is by examining the formats of similar questions used in past studies. For Corps CVM studies this means examining the Office of Management and Budget approved questionnaires for Corps planning studies (Refer to Annotated Reference #4 at the end of this chapter). The most similar generic questions are examined and decisions made as to how they could be adapted for use in the new CVM study.

Question Placement. Formatting the most effective placement of questions in the questionnaire is an important design consideration. The questioning should begin with questions that are easy to answer and which obviously relate to the expressed purpose of the study. This does two things. First, it gets respondents started on the interview with the least possible risk of stumbling on the first questions. It is important to avoid any perceived difficulty with answering the first questions, because this can produce refusals to go any further. Second, questions at the beginning of the questionnaire that obviously are central to the study purpose help establish credibility among skeptical respondents, causing them to take more interest and care in answering subsequent questions.

The questions most central to the purpose of the study should be asked next, as soon as possible after the obvious and easy questions. In CVM studies, the questions most central to the purpose are those concerning supply, demand, and willingness-to-pay. Open or closed ended formats may be used to obtain the willingness-to-pay information.

Questions about income, education, occupation, and other personal characteristics that respondents might be reluctant to answer should be placed at the end of the questionnaire. It is not as critical if respondents refuse to answer one or more of these at the end of the questionnaire. Refusals to answer objectionable

questions at the beginning of the questionnaire often result in refusals to answer subsequent questions. After the majority of the survey questionnaire has been completed, it is unlikely that a respondent will change answers to other questions already given.

Mail Format. Design of a mail survey requires considerable sophistication on the part of the research analyst in laying out the questionnaire, writing effective cover letters, and implementing the mail-out in carefully monitored "waves" timed to maximize response. One recommended design to use is a white 6 1/8" x 8 1/4" booklet of 16 pound paper for the mail questionnaire. When folded, this fits into a 7 1/2" x 3 7/8" envelope. Questions are typed on standard 8 1/2" x 11" paper and reduced 79 percent to fit the booklet pages and leave adequate margins. No questions should appear on either the front or back cover of the booklet. The front cover of the booklet should display an appropriate graphic illustration to stimulate interest. The front cover should also contain the title of the study, the name and address of the sponsor, and any instructions necessary before filling out the questionnaire. Inside the booklet, questions should be typed in lower case letters and numbered consecutively on the left side of the page. Answer categories for the questions should be in upper case and preceded by numbers which the respondent is instructed to circle to indicate his or her answer. Answer categories should be positioned in a vertical line down the center of the page. Ample "white space" should be left between the questions and along the margins. The back cover of the booklet should contain nothing more than an invitation to the respondent to make additional comments and a thank you statement.

DESIGNING VALID AND RELIABLE QUESTIONS

All questions in the survey questionnaire must be both valid and reliable. Validity means that the CVM survey questions are measuring the economic value and other types of data in the way that these data are supposed to be measured. Reliability means that the same survey questions would consistently elicit the same answers from the same respondents on repeated occasions, with every respondent interpreting each question the same way.

Question Wording. One of the most important considerations for assuring valid and reliable questions is careful question wording. Each word in a question should be evaluated by the analyst to assure that it will clearly convey the meaning intended. Words with many dictionary meanings should be avoided, and questions should be written in as simple and straightforward a manner as possible. Words should be chosen which will be easily understood by respondents with the lowest level of education in the population to be surveyed.

Practically every word in a question should be examined to see if different meanings could be attributed to it by different people (unreliability). Any ambiguous words should be replaced or

eliminated. For each question, use both a dictionary and thesaurus to identify the simplest words possible with the least number of meanings. Word emphasis can also be used to ensure conveying the proper meaning of a question. A key word can be emphasized in a question by underlining it, by typing it in CAPITAL LETTERS, or by putting "quotation marks" around it.

Question Structure. The way in which questions are structured can also affect validity and reliability. Anything in the question structure which biases the respondent's answer can invalidate a question. The structure of the response categories also can affect question validity and reliability. Response categories provided for structured questions should be both exhaustive and mutually exclusive. If the possible answers provided are not exhaustive, the question is invalid for those respondents who would like to answer in a way other than those provided. They will either refuse to answer or will answer incorrectly. If question response categories are not mutually exclusive, the question is unreliable because respondents can legitimately give a different response each time they are asked the question.

WRITING CONTINGENT VALUATION QUESTIONS

What is the Contingent Valuation Method? The contingent valuation method (CVM) is defined as "any approach to valuation that relies upon individual responses to contingent circumstances posited in an artificially structured market." A wide array of approaches are included within this definition, but the most common are bidding approaches.

Iterative Bidding. In the iterative bidding approach, respondents are confronted with a structured choice situation where a decision must be made involving a trade. The underlying justification for this iterative questioning procedure is that it forces the individual respondent to continuously re-evaluate the decision and "hone in on" a reliable response. It is essentially an auction process and has the properties of such processes, when conducted by a properly trained interviewer.

For example, after determining the cost of an annual waterfowl hunting license, the following question could be posed: "Would you continue waterfowl hunting if a license cost 'X' annually?" There are two choices, hunt or quit hunting. If the response is "yes", then the cost of the license, X, is increased and the question is repeated. This procedure is conducted iteratively until a "no" response is obtained. The "no" response indicates that (1) waterfowl hunting is not valued any higher than the amount to which the individual previously responded "yes" and (2) at any higher amount the individual would quit waterfowl hunting. A "no" response to the initial question would cause the survey interviewer to perform the above process in a downward direction.

If a "no" response is obtained for all amounts, then the interviewer would ask the respondent a follow-up question to determine whether (1) current license fees are at a threshold level where the hunter would quit ("a little more and I would quit") or (2) the hunter objects to the idea of increased license fees or license fees in general. Respondent bids falling in the second category are usually considered to be protest bids and not legitimate zero valuations. Thus, in most cases, these responses are deleted from the data set.

Non-iterative Bidding. In non-iterative bidding the iteration is removed from the questioning procedure. A non-iterative version of the previous question is: "Would you continue waterfowl hunting if a license cost $25 annually?" After obtaining a "yes" or "no" response the question is judged to have been completely administered. But a value amount for the question must be preselected. An alternative to circumvent this problem reads: "I would not continue waterfowl hunting if a license cost $_____ annually." The respondent must then choose an appropriate amount.

The preceding two bidding questions provide a useful distinction between non-iterative bidding formats: those which use close-ended and those which use open-ended questions. The former (close-ended) formats allow the analyst to examine the proportion of a sample subgroup which responds favorably to a specific preselected offer amount. These proportions may be used to derive a demand schedule reflecting alternative prices. The selection of analysis routines is extremely important with this close-ended form of question structure. Individual responses do not indicate the maximum value of the commodity, only whether the suggested price is acceptable. In contrast, both open-ended and iterative bidding seek to find the respondent's actual (or threshold) willingness-to-pay (consumer's surplus) directly.

FIELD TESTING A CVM QUESTIONNAIRE

Ideally the CVM questionnaire should be field tested and revised repeatedly until it works well. This ideal of perfection may never be achieved, but should be conscientiously sought in the preparation of every CVM questionnaire. The effectiveness and efficiency of the draft questionnaire should be tested with respondents similar to those in the population to be surveyed. This should initially be done face-to-face, even with mail and telephone questionnaire formats. After each pretest interview, the respondent should be probed for any difficulty experienced in understanding or answering the survey questions. If any problems are discovered with the questionnaire, revisions should be made. Then the revised questionnaire must be further pretested, both to see if the revisions have corrected the problems and to continue searching for other potential problems. It is usually necessary to revise a questionnaire several times before the analyst feels

confident that it is an effective and efficient data collection instrument to use for the study.

In addition to pretesting the questionnaire itself, the method of administration of the survey should also be pretested. This involves interviewer procedures for administering personal interview or telephone surveys, and mail-out procedures for mail (self-administered) surveys.

WHAT WAS DONE

BUFFALO BAYOU INFORMATION NEEDS

Three general groupings of questions emerged for the Buffalo Bayou questionnaire: 1) a group of questions concerning outdoor recreation participation, motivations, and facility/service preferences; 2) a group of economic questions concerning outdoor recreation value, quantity demanded, and supply adequacy; and 3) a group of questions concerning each respondent's socio-economic characteristics. These were the types of questions needed to achieve the study objectives.

With respect to the study objectives, economic value of recreation was the most important information needed. It was derived through the use of "contingent valuation" questions in the survey instrument.

QUESTIONNAIRE DEVELOPMENT

Question Development. A rough draft of the contingent valuation scenario and questions and each of the other question types specified in the description of information needs was prepared. Generic questions of these types from previously approved Corps questionnaires were identified. Question formatting and wording changes were then substituted and/or added to appropriately "shape" the generic questions to the specific needs of this study.

Decision to Use Mail Survey. A mail survey with self-administered questionnaire was decided upon as best for this CVM study, for reasons relating to both the nature of the study and the time frame. This was a very sophisticated CVM study, and data collection had to be completed within approximately 6 months time from when the study was initiated and the design of the quesionnaire begun. Preliminary results were required within four months of the initiation of the study and before the entire data collection effort was completed.

Given the short time frame, a telephone survey was first considered because it is normally the fastest method of getting survey results. However, it was ruled out because of the sophisticated nature of this CVM study. Visual illustrations were necessary for respondents to understand the kinds of potential future recreational developments that were being considered.

Showing illustrations requires either face-to-face personal interviews or mailing the illustrations to respondents. Personal interviews for a region as large as the Houston area of Buffalo Bayou and tributaries were ruled out as too costly and time consuming. Mailing the illustrations appeared to be the only alternative. Thus, a mail survey was selected as the most appropriate method to efficiently and effectively conduct this CVM study.

Mail Questionnaire. The mail questionnaire was then developed. The final survey questionnaire is shown in Appendix A. It consisted of 11 pages of questions and two pages of illustrations, in the form of a booklet using 8 1/2 " by 11" pages, rather than the preferred reduced size booklet referred to earlier. The amount of detail in the map illustration and the extensive amount of single spaced instructions needed precluded use of the smaller booklet size. The cover page had the emblem of Texas A & M University in the center, with the title "Outdoor Recreation Survey" above it. The two Departments at Texas A & M who conducted the study were identified below the emblem. A four sentence paragraph indicated to respondents that they had been randomly selected to receive the questionnaire, and that all information provided would be kept confidential. A final sentence at the bottom of the page requested respondents to please return the questionnaire in the self- addressed postage paid (first class) envelope provided.

After the cover page, the questionnaire was divided into three general parts. Upon opening the booklet, respondents found the first question of the first part of the questionnaire on the back side of the cover page. This question was easy to answer. It also obviously related directly to the title of the questionnaire, by asking whether or not respondents and other household members had participated in 25 popular Texas outdoor recreation activities during the previous 12 months. The rest of the first section of the questionnaire followed on the next three pages, each page having increasingly more difficult questions. After question one asked about respondents' participation in each of the 25 outdoor recreation activities, question two asked respondents to recall the frequency of their participation in outdoor recreation and the average number of household members participating per occasion. In contrast to question one, asking about 25 different activities, question two asked respondents to answer with respect to only five general activity "packages." These represented the types of activities for which facilities were being considered. Questions three and four asked how far household members usually traveled to participate in each of the five activity "packages," and the adequacy of the existing supply of outdoor recreation facilities in the Houston area for each of these five types of activities. Questions five, six, and seven measured respondent motives and facility preferences for the one activity package out of the five that they participated in most often.

The second section of the questionnaire consisted of a group of economic questions concerning Houston residents' demand for and value attached to proposed recreational developments for Buffalo Bayou and tributaries. That section of the questionnaire was six pages long. It began on page five with a three paragraph explanation of the types of recreational developments being considered for the Buffalo Bayou project by Corps planners. That page of the questionnaire referred to drawn illustrations on the opposite page of "natural" and "more developed" alternatives for potential bayou detention area parks, and an illustration of a typical bayou edge trailway for recreational activity. A question asked respondents to indicate whether they would prefer bayou detention areas as depicted in the "natural" illustration or as depicted in the "more developed" illustration. This question (Q-8) was situated at the bottom of page five.

A map of the Houston area including Buffalo Bayou and its tributaries was on the back side of the page depicting the "natural" and "more developed" detention areas and the bayou edge trailways. This map included the names and locations of Buffalo Bayou and its Houston area tributaries. It also indicated which bayous were being considered for potential recreational edge development and where bayou detention area parks might be located. Question nine was on the next page facing the map. It asked respondents to look at the map and to indicate whether or not they would use each of the proposed bayou and detention area developments during a typical year. It also asked respondents to give an estimate of the number of days per year members of their households would use each of the proposed recreational development locations.

The next two pages contained the contingent valuation questions, together with one question to identify substitution effects and another to identify protest values. Both a dichotomous choice and an open ended contingent value question (Q-12) were included. A subsequent question (Q-14) in this economic section of the questionnaire asked respondents to allocate the total value they gave in response to the open-ended CVM question among the thirteen possible development locations.

The last major section of the questionnaire consisted of socio-economic questions, Q-15 through Q-28. Two more questions followed the socio-economic items. These questions (Q-29 and Q-30) were included to allow respondents to rate how understandable they found the questions (a reliability issue), and also how accurate they thought their answers were to the dichotomous choice CVM questions (a validity issue).

Questionnaire Revisions. The questionnaire presented in Appendix A was the result of several pretest and revision iterations. The draft questionnaire was first pretested with students and colleagues on the Texas A & M University campus who

were familiar with the Houston area. Each was told the purpose of the study and asked to fill out the questionnaire as if they had received it in the mail at a Houston residence. They were then asked if they had any problems understanding or answering any of the questions. Based on their comments, wording changes were made to improve the questions.

Next the questionnaire was pretested with several Texas A & M alumni who were identified as then living and working in the Houston area. Appointments were made by telephone with those agreeing to assist in pretesting the questionnaire, and two trips were made to Houston to interview individuals with the questionnaire. Again, these individuals were each told the purpose of the study and asked to fill out the questionnaire as if they had received it in the mail at their Houston residences. Based on their comments and suggestions in filling out the draft questionnaire, revisions again were made.

Next the questionnaire was pretested with weekend picnickers at a large park on the west side of the Houston area to be included in the study. It was felt that these recreating Houston residents were the best pretest representatives of the population to be surveyed. They were participating in one or more of the activities the study was addressing. As with the prior pretest interviews, these individuals were asked to complete the questionnaire as if they had just received it in the mail at their Houston residences. Based on their comments and suggestions, the questionnaire again was revised.

Galveston District and Institute for Water Resources personnel were sent copies of the original draft questionnaire and the revised versions as the pretesting progressed. Some revisions also were also made in the questionnaire as a result of initial reactions to it by these Corps personnel.

Question number nine was revised several times in an effort to get more detailed information desired by Corps personnel on potential future use of the proposed bayou edge developments and detention area parks. The final version of this question represents a compromise between the level of detail Corps personnel requested and objections on the part of pretest respondents to the level of difficulty posed by such a hypothetical question. What was desired from question 9 were data on the "average" number of days per year "per household member." During the pretest, respondents indicated this wording made the question too complex. Leaving the wording in the simpler, but less precise format shown in Appendix A likely compromised the reliability of the data obtained.

WHAT WAS LEARNED

The main thing learned was that design of the survey should have started much earlier in the planning process. Had design been initiated several months earlier, the questionnaire probably could have been refined to the point where the response rate would have been much higher. In addition to refining the questionnaire, there also would have been time to pretest different survey procedures. One which was discussed was to use two questionnaires, an initial questionnaire to gather data for a recreation development plan and a subsequent questionnaire to measure the benefits of that plan. Additional time up front would have allowed testing of this and other survey design alternatives, with the end result of improved response and improved quality of data.

Survey design is an art. Questionnaires must be field tested several times, carefully making indicated revisions after each field test. Only in this way can the best final questionnaire for the study be achieved. This is an iterative process which takes time and care. Its importance cannot be overemphasized.

It also is important to involve all those who intend to use the final information in the initial questionnaire development and review processes. This should begin with a meeting of the research analysts together with all involved Corps personnel. Here the initial types of questions needed to address study objectives should be agreed upon. Later, after the analysts have prepared a first draft of the questionnaire, everyone should again meet together to jointly review the questions. Revisions can then be made to ensure that the questions being asked are eliciting the kind of information desired by the planners and others who will eventually use that information.

Questions concerning respondents' future intentions are particularly challenging for the research analyst to write. More research is needed on the design of these types of questions. No one can answer with complete certainty about the amount of outdoor recreation in which they will participate at a particular future time and place. However, people can give their generalized intentions. How this translates into real future behavior and the level of detail about future intentions that respondents can reasonably be expected to give needs much more research and documentation.

It was learned from the two check questions included at the end of the present study questionnaire that most respondents felt confident that their answers to the questions were reasonably accurate. Most also felt that their answers to the CVM valuation questions were consistent with what they would actually be willing to pay for the future outdoor recreation opportunities they were being asked to value.

ANNOTATED REFERENCES

1. Babbie, Earl (1986) The Practice of Social Research, 4th Edition. Wadsworth Publishing Company; Belmont, CA.,577 p.

   This is a very easy to read comprehensive book on social research methods. Several chapters and appendices in the book deal specifically with survey research design, implementation, and analysis.

   For questionnaire design, the following chapters are recommended:

   Chapter 4: Research Design
   Chapter 5: Conceptualization and Measurement
   Chapter 6: Operationalization
   Chapter 9: Survey Research

   In Chapter 4, the section entitled "How to Design a Research Project" is particularly relevant for CVM surveys. In Chapter 5, the material on reliability and validity in the section entitled "Criteria for Measurement Quality" is highly recommended. In Chapter 6, the section entitled "Guidelines for Asking Questions" is recommended. All of Chapter 9 is recommended reading.

2. Dillman, Don A.(1978) Mail and Telephone Surveys, The Total Design Method. John Wiley & Sons; New York.325 p.

   Dillman does a very good job of packaging much important detail on survey design in a very systematic and straightforward manner. This book is an especially good reference for surveys administered by mail or telephone. Extensive explanation is given for design and implementation of surveys using each of these methods. The material on mail surveys is considered by many researchers to be the best available. Those who follow the Dillman method of mail survey administration routinely get relatively high response, often as high as with other survey methods. This book was the principal reference for writing the first half of this chapter.

   For questionnaire and mail survey design, the following chapters are recommended:

   Chapter 2: Which is Best, The Advantages and Disadvantages of Mail, Telephone, and Face-to-Face Surveys
   Chapter 3: Writing Questions
   Chapter 4: Constructing Mail Questionnaires

3. Hodgson, Ronald W.(1986). "An Example of a Mailed Contingent Valuation Survey Method in a Marina Feasibility Study."

Instruction Report R-86-1, U.S.Army Corps of Engineers Waterways Experiment Station. Vicksburg, Mississippi.

This report is similar to the present case study, in that it describes how contingent valuation data were collected by mail survey to value recreation resources. It differs by being a marina example instead of an application to an urban population. It also places less emphasis upon data analysis and modeling than the present study. Two chapters (called "Parts") are particularly relevant to the present study's chapter on questionnaire design:

Part IV: The Contingent Valuation Questionnaire.
Part V: Organizing the CVM Questionnaire.

Part IV contains three versions of the CVM question used in the marina study. Part V contains important detail on several aspects of constructing high quality mail questionnaires.

4. Moser, David A.and C.Mark Dunning (1986). "National Economic Development Procedures Manual - Recreation, Volume II, A Guide for Using the Contingent Value Methodology in Recreation Studies." IWR Report 86-R-5. U.S.Army Corps of Engineers Water Resources Support Center, Institute for Water Resources. Fort Belvoir, Virginia.

The following parts of this report are very good supplementary reading for this chapter of the present manual.

Chapter III: Design of the Survey Instrument.
Appendix A: CV Questionnaires for Corps Planning Studies

Moser and Dunning devote most of Chapter III to discussion of the necessary components of an adequate contingent valuation section to the questionnaire. This discussion includes sections on the payment vehicle, iterative bidding, open-ended willingness-to-pay questions (with an example of a payment card), closed ended willingness-to-pay questions, option/ existence value, and protest questions. An example is given of the types of closed ended responses to use for a protest question. In addition, Appendix A of this manual provides draft "generic" CV questionnaires that can be used in the early stages of questionnaire development.

CHAPTER IV
SAMPLE DESIGN AND SURVEY ADMINISTRATION

CONCEPTS AND OBJECTIVES

The appropriate population to sample and the appropriate sampling technique must be determined before a CVM survey sample can be drawn and the survey administered. These are important steps in any survey and careful thought should be given to each if the survey is to provide valid results. If the wrong population is sampled, or if the sample is not selected so as to appropriately represent the population, the results may be unusable.

An appropriate survey sampling technique should provide a representative estimate of the population characteristics and other information desired for the entire population from which the sample is drawn. Sample estimates are within a determinable margin of error, depending upon the size of the sample and the variation in the characteristics being measured. The key to ensuring a representative estimate of the characteristics being measured is random sampling. Representativeness of a random sample can be further improved by stratifying the population listing(s) from which the sample is to be selected.

IDENTIFYING RELEVANT POPULATION

It is important to define the appropriate population to sample for a CVM study. If the population sampled is not the relevant population, results will not be generalizable as required to address the study objectives. For valuation of established outdoor recreation sites, the relevant population would be the actual users of the sites. For valuation of proposed outdoor recreation sites, the relevant population would be the people most likely to use the sites. For proposed urban outdoor recreation sites, the most likely future users of the sites are the urban area residents.

Before sampling, the relevant population identified must be more specifically defined. This is commonly called developing a "sampling frame." The sampling frame must define, for sampling purposes, exactly which members of the overall population are to be included in the final population sampling listing. For example, a population of residents of an urban area may be reduced to a sampling frame by including only those residents who are adults, competent to understand and respond to the CVM questionnaire. It may be further reduced to include only those adult residents with telephones, if telephone book listings are to be used for drawing the sample.

CHOOSING APPROPRIATE SAMPLING TECHNIQUE

Choice of the appropriate sampling technique includes both the choice of how a random sample is to be selected and from what type of listing(s) the sample is to be selected. How a random sample is

to be selected is usually a choice restricted to the alternatives of a simple random sample with replacement, a random sample without replacement, or a sequential sample with a random starting point. The type of listing the sample is to be drawn from includes the physical nature of the list itself and whether or not the list is or can be stratified. A commonly available type of listing for sampling of residential households is the telephone directory. It can be stratified by telephone exchange, and also geographically by the listed addresses of telephone subscribers.

Other types of lists commonly available include listings of metered water customers, electricity customers, and gas company customers. All of these are biased toward homeowners and residents who can afford these services. The latter bias is also true for telephone subscribers. Many telephone subscribers are also unlisted, and not including them may also introduce some bias.

Random Sampling. Sampling is random when all qualifying individuals in the surveyed population have an equal chance or known probability of being selected in the survey sample. Random sampling is most commonly conducted for CVM surveys by using what is called a random sample without replacement. As each household or individual is drawn from the population listing being used, they are deleted from the list and do not have further chances of being selected. Although this slightly increases the probability that remaining members of the population will be selected, the effect upon the overall representativeness of the population is negligible. For a simple random sample, every qualifying member of the surveyed population should have a chance of being drawn in the sample at every draw. However, it usually does not make sense to interview the same person more than once. Once drawn from the sampled population, their name is not allowed to be drawn again.

A modification of random sampling that is acceptable is to randomly select only the starting point for a sequential sample drawn at equal intervals from a population listing. The size of the sample desired is determined. This number is then divided into the size of the qualifying population list. The resulting number is then used to systematically draw every "n"th person or household on the list to constitute the sample. Randomization is achieved by using a random number table or some other acceptable way of randomly choosing which person or household shall be the first one on the list to be selected for the survey. Every "n"th person or household after that is then selected until the population listing is exhausted. The resulting sample can be called a random sample if the starting point was randomly selected, and if it can be assumed that the list is itself randomly constituted. An alphabetical listing such as found in a phone book is often assumed to be essentially random.

Stratification. Stratification means dividing the population listing into several smaller lists corresponding to characteristics

of the population being sampled. Place of residence is one such characteristic used to stratify a population. To stratify an urban population based upon place of residence, for example, two lists could be created - one for residents living on the south side of town and another for those living on the north side of town. The same type of random sample would then be drawn from each of these two lists. The result would be to eliminate sampling error with respect to proportionately representing these two geographic parts of the city. Stratifying the population list before drawing the sample will decrease the overall sampling error by eliminating the error for the characteristic(s) upon which the sampling list is stratified. Thus, a stratified random sample is often preferable to a random sample that has not been stratified.

DETERMINING SAMPLE SIZE

Sample size is mainly determined by the amount of error that will be tolerated in measurement of important study variables. When stratified random samples are drawn proportionate to the size of the various population strata, smaller population strata will have larger sampling error than larger strata. This is because the amount of sampling error is inversely related to sample size. If this error becomes intolerably large, the smaller strata must be oversampled by drawing proportionately larger subsamples from them than would otherwise be the case. The resulting larger weighting of the sample estimate for these particular strata must later be taken into account if the strata are combined for analysis.

Larger sample sizes may also be required for certain smaller strata of the population being sampled when these strata are more important to the study objectives than certain other strata. For example, if it is known that recreation facilities will be developed in some parts of a study region but not in others, it makes good sense to oversample those particular parts of the region. Oversampling of these population strata is conducted to reduce their sampling error and improve the accuracy of sample estimates for measured characteristics of the households or individuals comprising these strata.

DRAWING THE SAMPLE

After adequately defining all aspects of the chosen sampling technique to be used, including size of sample(s) needed, the next step is to actually draw the sample. The sample can either be drawn by the research analysts themselves, or this can be sub-contracted to firms specializing in drawing samples. Firms with continuously updated computer banks of telephone book listings for the entire United States are sometimes more cost and time efficient for researchers to employ than drawing their own sample using the books themselves. This is not necessarily the case if listings other than phone books are used.

Drawing the sample for a CVM household survey involves drawing the number of names and addresses from the sampling frame list(s)

necessary to achieve the desired sample size. Once this is completed the assumption is that a respondent in every household drawn as part of the sample will be contacted and will provide answers to the survey questions. This almost never happens, because some selected household occupants cannot be reached or refuse to cooperate. It is usually assumed that, over the whole sample, these refusals are for random reasons and do not materially affect the representativeness of the final sample estimates. However, some check on the reasons for this non-response is necessary to determine whether or not any systematic biases do exist. If identified, such biases can then be taken into account in the final data analysis.

Thus, the final step in sample administration is to check on the reasons for nonresponse and identify any effects of this upon sample representativeness. This can be done both indirectly and directly. The most common indirect method is to compare sample characteristics with the same characteristics reported for the sampled population by the most recent U.S. Census. A common direct method of checking for sampling bias for mail CVM surveys is to conduct a telephone survey of a sample of mail nonrespondents and ask them their reasons for not responding.

ADMINISTERING A MAIL CVM SURVEY

Administering the Mail-Out. Administration of the mail-out should be conducted using a "wave" technique of multiple mailings. This involves timing the various waves or mailings so that they are both feasible and effective. With a large sample, thousands of questionnaires and cover letters must be stuffed into envelopes together with a stamped self-addressed return envelope. This can take days to prepare and must be coordinated with receipt of the required number of questionnaires and envelopes. Printed questionnaires and letters generally are preferable to photocopied questionnaires, unless desk top computer laser printers or equivalent quality copying equipment can be used. If sent to a printing company, questionnaires must be printed with enough advance lead time to meet mail-out deadlines.

Each wave after the first mailing is mailed only to those who have not yet responded to the survey. One exception is that a post card is often mailed to everyone very shortly after the first mailing goes out. This post card urges everyone to respond to the first mailing and includes a thank you for those who have already mailed in their completed questionnaires.

Printing of all questionnaires needed for the study should generally be done in two or more batches. The amount of non-response to the first mailing will determine how many questionnaires should be printed for the next mailing, and so on for subsequent mailings.

Administering Response. Response to the mail-out also must be carefully controlled. Each questionnaire mailed out should be coded with a number which is checked off from a master list when the completed questionnaire is returned. This requires daily attention. If not done, some respondents may receive one or more additional questionnaires after they have completed one and mailed it back. This is both annoying to the respondent and a waste of study resources. A computerized sampling list can be updated every day to delete those who have responded to the survey.

WHAT WAS DONE

POPULATION SAMPLED

The relevant population to sample for the Buffalo Bayou study was identified as all residents of the city of Houston. This was more precisely defined as a sampling frame comprised of all Houston residents with addresses listed either in current Houston telephone directories or on Houston motor vehicle registrations. This Houston sample population was further divided into ten geographic strata (sub-watersheds), based upon the location of Buffalo Bayou and its tributary bayous. The final definition of these ten sub-watersheds was determined after consultation with the Galveston District Office of the Corps and is shown in Figure 2 (page 7). The study region covered 1,034 square miles of land and had a total population of over 1,800,000 people in 1980. The largest share of the study region population resided in Brays, Buffalo, and Sims Bayous.

Each of the ten bayous were defined in terms of the census tracts of which they were composed. Criteria for allocation of census tracts to bayous were as follows:

a) The census tract had to be situated within Harris County.

b) Fifty percent or more of tract had to be within the overall Buffalo Bayou study region as defined by the Galveston District of the U.S. Army Corps of Engineers.

c) Fifty percent or more of tract had to be within the watershed to which it was allocated.

d) If more than fifty percent of the tract was within the study region but less than fifty percent was within any specific watershed, then the tract was allocated to the watershed having the largest percent within its boundaries.

DRAWING THE SAMPLE

The geographic strata defined by the ten bayous were used to draw ten separate population samples, each on the basis of their 1980 Census populations. Fortunately, population and other census information was available by bayou from previous Corps inventories.

A reputable survey sampling firm was subcontracted to draw random samples without replacement for each of the bayou strata. The sampling firm has a nationwide data base of names and addresses which exceeds 74 million households. This data base is compiled from all existing telephone directories and from auto registration data for states which treat this latter information as publicly available. The firm's personnel continually update this data base, compiling and storing it in a computerized retrieval system. Each telephone directory household listing and auto registration listing is carefully compared with households identified from listed telephone numbers, and duplicate entries are eliminated.

The initial sample size was 6,000 households (Table 3). The head of each household was to be asked to give information representing all members of the household. Therefore the ultimate unit of analysis was all residents of Houston, and the 6,000 households to be sampled were initially allocated proportionately to the populations of each of the ten bayous. Upon examining the distribution of the total sample among bayous, the research analysts decided there should be some additional considerations governing allocation of the sample among the ten. These were: 1) No bayou would receive an allocation of less than 300 household addresses and names, 2) The sample size for Sims Bayou was reduced from 870 to 500 households because initially no project-related recreational development was considered for that bayou, 3) The reduction in sample size for Sims Bayou was allocated to Greens and Buffalo Bayous. This was because Greens Bayou had the largest amount of proposed development, and developments are proposed on all sides of Buffalo Bayou. A larger sample for each of these two bayous would result in lower sampling error, and it was considered more important to have lower sampling error for these bayous where much of the development was being considered.

SURVEY ADMINISTRATION

Procedures for administering the survey followed the procedures for mail surveys described by Dillman (1978) in his book on mail and telephone surveys. Three different cover letters and one post card (Appendix A) were prepared in addition to the mail questionnaire described in Chapter III. These were used for carefully controlled repeated mailings to maximize response to the CVM survey.

Table 3. Allocation of Sample Among the Ten Study Area Bayous

Bayou	Sampling Group Sampling Number	1980 Population	Minimum Sample Households Size	Initial Group Sampling Rate[1]	Initial Sample Households Size	Revised Sample Households Size[2]	Final Group Rate
White Oak Bayou	1	244,500	---	.0029	709	709	.0029
Addicks Reservoir	2	23,800	300	-----	300	300	.0126
Barker Reservoir	3	22,500	300	-----	300	300	.0133
Greens Bayou	4	158,000	---	.0029	458	790	.0050
Halls Bayou	5	118,000	---	.0029	342	342	.0029
Buffalo Bayou	6	333,000	---	.0029	966	1,000	.0030
Hunting Bayou	7	90,000	300	-----	300	300	.0033
Carpenter Bayou	8	31,000	300	-----	300	300	.0097
Brays Bayou	9	504,000	---	.0029	1,459	1,459	.0029
Sims Bayou	10	300,081	---	.0029	870	500	.0017
Study Region Total	-	1,824,881	---	-----	6,004	6,000	.0033

1 Sampling rate determined after removing population of groups assigned the minimum size.
2 Reallocated sample from Sims Bayou to Buffalo and Greens Bayous which are closer to proposed project recreational developments.

The post card and cover letters were written by the two co-directors of this research project, with the objective of convincing the recipients to respond to the questionnaires. This was done by telling them "we need your help" in terms of how they felt about the availability of outdoor recreation areas within the Houston area. They were told that, with their response, they would have the opportunity to influence the planning of recreation facilities associated with flood control developments in the Houston area. They were also told that they were selected randomly, that their response was important to the study, and that the confidentiality of their responses would be safeguarded. In a further attempt to induce their response, they were offered the incentive of a copy of a summary report upon completion of the study. The post card and all letters mailed were hand signed by the project co-directors, to personalize the appeal for response.

The chronological sequence of the mailings and responses are summarized in Figure 3 and Table 4. The initial cover letter and questionnaire were mailed first class on May 19, 1986 to all addresses drawn in the sample of 6,000 referred to above. After approximately one week, a post card follow-up was mailed to thank those who had already responded and to encourage others to do so promptly. After two more weeks, on June 9, 1986, a second cover letter and copy of the questionnaire were mailed to addresses of those who had not yet responded. The second cover letter emphasized the importance of the survey responses to recreation planning for the Houston area.

Four weeks later, on July 7, 1986, the third and final letter was mailed together with another replacement questionnaire to those who had not yet responded. This was seven weeks after the initial mailing. This final effort to persuade non-respondents to respond again emphasized the critical importance of the data being collected for outdoor recreation planning to meet the desires of Houston area residents. In addition, the importance of receiving a completed questionnaire from everyone contacted was emphasized. This was emphasized because some respondents had mailed back written comments earlier saying they did not think they should respond because they did not use outdoor recreation facilities themselves. It was important to communicate to them that their zero-use responses were also important to the accuracy of the survey results.

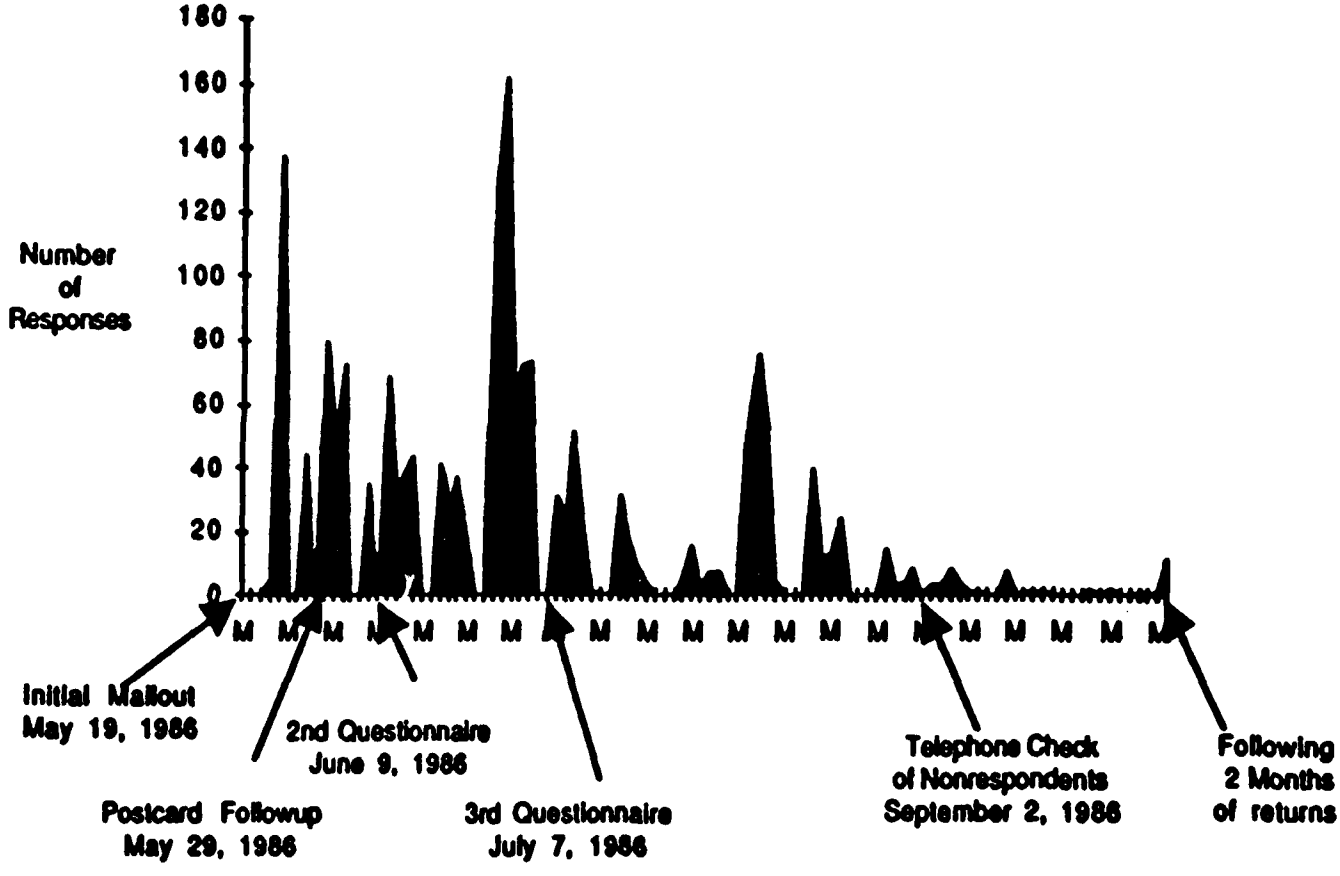

Figure 3. Chronological Display of Survey Response Rate

Table 4. Results of Survey Administration and Response

Item	Total Number	Total Percent
Questionnaires mailed	6000	100.0
Undeliverable Questionnaires:		
a. Not deliverable as addressed, unable to forward	395	
b. Insufficient address	212	
c. Moved, left no address	532	
d. Forwarding ordered expired	136	
e. No such number	41	
f. No mail receptacle	3	
g. Addressee unknown	95	
h. Deceased	31	
i. Other	92	
Total Undeliverable	1537	25.6
Deliverable Questionnaires[1]	4463	100.0
Questionnaires Returned	1810	40.5[2]
Unusable Questionnaires[3]	139	3.1
Usable Questionnaires	1671	37.4

[1] Assumes all undeliverable questionnaires were returned to the research team. Although first class postage was used, it is still unlikely that all undeliverable questionnaires were accounted for. This implies that the actual response rate reported here is an underestimate.

[2] Percent of deliverable questionnaires.

[3] Duplicate responses, blank questionnaires, and miscellaneous enclosures.

Each cover letter and the post card also had a written Spanish language appeal for response. This was for the portion of the Houston sample known to be Spanish speaking. The first cover letter asked those preferring a Spanish language questionnaire to write their name and address on blanks provided at the bottom of the page, to tear this part of the page off, and to mail it back in the self-addressed return envelope enclosed. The follow-up post card and the second and third cover letters asked those preferring a Spanish language questionnaire to telephone their request collect to one of the project co-directors.

Scheduling Questionnaire Printing. The questionnaire itself, cover letters on Texas A & M letterhead, and addresses on envelopes were all type set by a printing company. This was done to improve the appearance of the mail-out package and thereby improve response to the CVM survey. The printing took time, however, and had to be carefully scheduled as part of the survey administration process.

It took approximately two weeks for the printer to prepare the initial batch of questionnaires for the first mailing. This was because some mistakes by the typesetter had to be corrected before printing could begin. Delivery of the initial questionnaires and the postcards was scheduled for ten days prior to the initial mailout date. This was necessary to allow the research analysts adequate time to hand sign 6,000 of each (important for maximizing response), and to stuff the mail out envelopes. Delivery of the second cover letter, the second batch of questionnaires, and envelopes for the second mailing was made approximately three weeks after the first delivery from the printer. The estimate of the number of questionnaires needed could not be given to the printer until after one week of returns had been received from the first mailing. The order for the quantity of questionnaires, letters, and envelopes needed for the third mailing was not given to the printing company until two weeks after the second questionnaire copies were mailed out. They were delivered approximately one week later, leaving one week to stuff the final mail-out envelopes.

Telephone Sample Check. A sequential sample of 95 nonrespondents was drawn from those households from the original sample of 6,000 which remained unaccounted for approximately two months after the final mailing. It was assumed that most of these households which had not responded to the mail survey could be reached by telephone to determine reasons for the mail nonresponse. However, it was only possible to contact 42 of the 95 nonrespondent households drawn for this telephone sample check, sixteen of which resulted in refusals to provide any information. Twenty-two of the 95 households had disconnected telephones, and twelve of the 95 telephone numbers were wrong numbers. Twelve of the 95 households could not be reached by telephone after five call-back attempts. Four of the 95 nonrespondents contacted claimed they had completed the mail questionnaire, though it was never received. And the telephone interviewer could not communicate with the person

answering the telephone at two of the 95 households, because of language barriers.

WHAT WAS LEARNED

Mail Waves are Necessary. The procedure of sending several different "waves" of questionnaires was confirmed as a very important consideration in administering mail CVM surveys. Each wave or mailing produced a flurry of additional response to the survey.

Spanish Language Questionnaire. Very few people responded to the Spanish language requests in the cover letters, which were intended for Hispanics who could not read the English language questionnaires. The first cover letter (Appendix A) requested that they tear off and mail back the bottom part of the letter, checking a box to indicate they needed a Spanish language questionnaire. The follow-up post card and the last two cover letters all requested anyone needing a Spanish language questionnaire to telephone the principal investigators long distance, collect.

This approach did not seem to work, because less than a dozen of these requests were received by mail or telephone. In addition to the extra effort required, perhaps some did not want to admit that they did not read English. Whatever the reason, almost all those who could not read English were lost to the sample. The lesson learned was that those conducting a CVM study must be more innovative to induce non-English reading households to respond.

One alternative would be to include a duplicate Spanish language questionnaire and cover letter along with every English version. This would have to be pretested to judge the possible negative effect on the responses of English reading respondents. A few English reading Houston respondents wrote notes when mailing in their completed questionnaires, complaining about including Spanish language sentences in the cover letters for non-English reading residents.

Telephone Sample Check. Implementing the telephone sample check indicated, that due to the inability to reach many potential phone respondents, a larger non-respondent sample should have been drawn if close to 100 telephone contacts were desired. A related point is that the size of non-respondent checks should be determined in relation to the size of the sample drawn and the response rate achieved. Large samples with low response rates warrant larger nonresponse checks to determine what went wrong.

ANNOTATED REFERENCES

1. Babbie, Earl (1986) The Practice of Social Research. 4th Edition. Wadsworth Publishing Company; Belmont, CA. 557 p.

   This is a very easy to read comprehensive book on social research methods. The following chapter and appendices are particularly recommended as supplementary reading for the present chapter's sampling component:

   Chapter 7: The Logic of Sampling
   Appendix D: Random Numbers
   Appendix E: Critical Values of Chi Square
   Appendix F: Normal Curve Areas
   Appendix G: Estimated Sampling Error

   Chapter 7 in Babbie's book provides a good overview of the foundations of survey sampling, with emphasis upon the different types of probability sampling techniques. Appendices D through F are what one would normally find in statistics books. Babbie does the reader a service by including them in this methods book.

2. Dillman, Don A. (1978), Mail and Telephone Surveys, The Total Design Method. John Wiley & Sons: New York. 325 p.

   This book is an especially good reference for surveys administered by mail or telephone. Extensive explanation is given for design and implementation of surveys using each of these methods. The material on mail surveys is considered by some researchers to be the best available. Those who follow the Dillman method of mail survey administration routinely get relatively high response, often as high as with other survey methods.

   Chapter 5, "Implementing Mail Surveys", should be required reading for anyone planning to administer a mail survey. This chapter provides a detailed recipe for exactly how to administer a mail survey. It includes examples of the optimum types of cover letters to use, follow-up timing, and other components which together produce high response rates.

3. Guenzel, Pamela J., Berckmans, Tracy R., and Charles F. Cannell (1983). General Interviewing Techniques, A Self-Instructional Workbook for Telephone and Personal Interviewer Training. Institute for Social Research, The University of Michigan. Ann Arbor, Michigan. 382 p.

   This is a very valuable reference for those who choose to conduct a telephone or face-to-face contingent valuation survey. It is a large loose leaf interviewer training manual with an accompanying 90 minute audio tape containing examples

of proper and improper interviewer performance. The audio tape examples follow a practice interview schedule of questions. Particular emphasis is placed upon: 1) the technique of probing for complete and accurate answers to questions, and 2) appropriate "feedback phrases" to reward and motivate respondents to give acceptable answers.

This training manual is set up to be used in one of three ways. It can be used as a self-teaching home study program in which the interviewer(s) to be trained take one or two weeks to read all of the material and complete all of the exercises. Alternatively, it can be used for classroom training of interviewers involving two seven hour days of intensive instruction and two hours of homework each day. It can also be used for a combination of classroom instruction and home study.

The manual is accompanied by a 68 page supplement of "Notes to the Supervisor/Instructor on the Development and Use. . ." of these materials.

4. Hodgson, Ronald W.(1986) "An Example of a Mailed Contingent Valuation Survey Method in a Marina Feasibility Study." Instruction Report R-86-1. U.S.Army Corps of Engineers Waterways Experiment Station. Vicksburg, Mississippi.

This report is similar to the present case report in that it describes how contingent valuation data were collected by mail survey to value proposed recreation (marina) developments. The following chapters (called "Parts") from Hodgson's report are particularly relevant to the present study chapter on sampling and survey administration:

Part IV: Selecting Respondents.
Part VI: Managing the Survey.

The chapter on selecting respondents (Part IV) presents a sampling example of a population of registered boat owners living within a certain distance of a lake. He explains how this population was stratified into three groups by boat length. Each stratum was then sampled proportionate to size. The chapter on managing the survey (Part VI) refers to the Dillman book referenced above with respect to the timing of the different mailings for a mail survey. Hodgson also recommends an added telephone survey of non-respondents if response is below 80 percent after all mailings. This requires a complete telephone version of the mail CVM survey instrument.

5. Moser, David A.and C.Mark Dunning (1986) "National Economic Development Procedures Manual - Recreation, Volume II, A Guide for Using the Contingent Value Methodology in Recreation

Studies." IWR Report 86-R-5. U.S.Army Corps of Engineers Water Resources Support Center, Institute for Water Resources. Ft.Belvoir, Virginia.

Their report is Volume II of the current three volume manual series. The following chapter in their report is highly recommended supplementary reading for the sampling component of the present chapter of the present case study report:

Chapter II: Sampling for Contingent Value Estimates.

This chapter is very well written, using an example of a random sample of 235 from a population of 1200 boaters. Measurement error in samples is explained in terms of how both the amount of variance, or homogeneity, and the sample size determine the amount of error. A correction factor is explained for finite populations when the sampling fraction is larger than five percent. Selecting a representative sample is explained in terms of five steps: 1) Identify the population, 2) Determine required precision, 3) Determine sample design, 4) Determine sample size, and 5) Select the sample. A good example is given of how to stratify and random sample the strata. An excellent detailed presentation is also included on how to draw a multistage cluster sample in a medium sized city.

6. Kish, Leslie (1965) Survey Sampling, John Wiley & Sons, Inc. New York.

This is an excellent book in terms of both depth and readability. The following chapters are particularly recommended:

Chapter 2: Basic Concepts of Sampling
Chapter 3: Stratified Sampling
Chapter 4: Systematic Sampling; Stratification Techniques
Chapter 13: Biases and Nonsampling Errors

CHAPTER V
ANALYSIS AND BENEFIT EVALUATION

CONCEPTS AND OBJECTIVES

Empirical analysis must naturally follow any major effort at data collection. Initially, data must be coded and checked to see whether they are representative of the population from which they were collected. To the extent possible, sources of potential bias must be examined. Preference information elicited from respondents is often useful both for explaining economic values reported as well as for the revision of project designs to more appropriately reflect public preferences. Finally, valuation results are of particular interest for the purpose of providing information specific to estimation of overall project recreation benefits. This recreation benefit information can then be used in a comprehensive benefit-cost analysis of the feasibility of adding the recreation component to the overall water resource development project.

WHAT WAS DONE

DATA CODING AND EDITING

After coding the data into computer files, analysis was initiated. Data coding was performed interactively with the use of microcomputers and the STATPAC software package. Data were then debugged and transferred to a mainframe computer for analysis. Statistical Analysis System (SAS) software was used for analysis of data on the mainframe computer. Results reported in this chapter are in the form of simple statistics, e.g., means and frequency of response.

BIAS CHECKS AND CORRECTIVE DATA ADJUSTMENTS

Data from the telephone sample of nonrespondents were compared to data from the mail survey respondents for seven different variables: whether respondents owned their homes, whether or not they planned to move from the Houston area, their annual household income, their race, whether or not they were retired, mean household size, and the mean amount of money their household spent on outdoor recreation in an average week. This analysis indicated that the nonrespondents were fairly similar to the respondents in terms of the first three of these variables. Differences between nonrespondents and respondents were identified for the other four variables. Nonrespondents appeared to represent proportionately fewer high income households, fewer white race households, and fewer retirees; and nonrespondents had more persons per household.

These results provided a preliminary indication that the mail survey may have been biased in these respects. However, only 26 of the 95 nonrespondent households sampled could be interviewed. Thus, these results can not be regarded as conclusive and only

present "indications" of similarities and differences, respectively, between study respondents and nonrespondents.

Because the nonresponse check was inconclusive a further analysis was conducted. The selected sample characteristics were compared to data from the U.S. Census for 1980. These data indicated that the respondent households came from higher income categories than the population of Houston as a whole. The sample also was more educated and had a lower proportion of black respondents than the population. The renter population also appeared to be underrepresented. The finding of differences is consistent with the follow-up telephone survey of nonrespondents described earlier. For this reason, the variables upon which these differences occurred were examined in the statistical modeling, for which results are presented in a later section.

In addition to the later reported statistical modeling examination of other socioeconomic variable influences, the data were adjusted for the difference between sample income category representation and that of the census figures. Weighting was proportional to the census population figures with weights for particular categories as follows:

Income Group	Weight
Less than $10,000	4.4565
$10,000 - $19,999	3.0795
$20,000 - $29,999	1.5811
$30,000 - $39,999	.8181
$40,000 - $49,999	.4207
$50,000 - $79,999	.2078
$80,000 or more	.1951

This weighting process attempts to correct for potential bias which results from the distribution of responses among income categories. For example, the proportion of the survey sample with incomes in the $10,000 to $19,999 range was about one third of what it should have been, based on the 1980 census data. Therefore data from those who did respond in that category were multiplied by a factor (weight) of 3.0795 to compensate for this sampling bias. Since income categories also reflect educational status, types of occupational categories, and often other population parameters, use of this variable for the adjustment process is an improvement over the unweighted version of the data set. Differential responses among income categories in mail surveys is not an uncommon problem and adjustment processes are commonly performed.

RECREATION USE ESTIMATES

Proposed Facilities. Based on the resource capabilities of the project area, an initial facility development plan was prepared. Recreation facilities were proposed for seven of the 10 bayou areas. The types and amounts of facilities for each of these areas is presented in Table 5.

Table 5. Proposed Recreation Facility Developments

Recreation Facility Development Location	Trails (Miles)	Picnicking (Tables)	Playgrounds (Acres)	Sports (Fields)	Boat/Canoe (Ramps)
Carpenters Bayou					
Edge Development	1.3	6	-	-	-
Brays Bayou					
Edge Development	6.8	20	-	-	-
Detention Area #1	1.5	80	2	8	-
Detention Area #2	0.9	60	2	8	-
Sims Bayou					
Detention Area #3	1.4	80	2	6	-
Greens Bayou					
Edge Development	11.1	40	-	-	1
Detention Area #4	0.9	30	1	4	-
Detention Area #5	0.9	40	1	6	-
Detention Area #6	1.3	60	2	8	-
Detention Area #7	0.9	30	1	4	-
Halls Bayou					
Edge Development	13.5	30	-	-	1
Hunting Bayou					
Edge Development	2.0	16	-	-	-
Little White Oak Bayou					
Edge Development	1.0	10	-	-	-

Facility Needs. The study area was designated in the Texas Outdoor Recreation Plan (TORP) as having a basic shortage of parks, open space, greenbelts, and neighborhood parks. Deficits determined from TORP facility needs estimates for 1995 and an inventory of currently existing facilities were compared to the numbers of facilities planned for each bayou. In each case the deficit exceeded the number of facilities planned, indicating a need for the proposed facilities. For example, below is the comparison for Carpenters Bayou.

Facilities Planned	TORP Needs	Number Existing	Deficit	Number Planned
Trails (miles)	3	0	3	1.3
Picnic Tables	186	4	182	6

Recreation Demand. Estimates of total recreation demand for the proposed developments were derived from responses to Question 9 on page 8 of the questionnaire. In this question, respondents were asked to indicate which, if any, of the proposed developments their households would use, and then to estimate the annual household use of each of the developments they indicated they would use. Although most respondents were able to indicate whether or not they would use specific developments, many were unable to provide estimates of the number of days of future household use. There was also some uncertainty as to whether respondents were *indicating* total household use or the number of days of use per household member (an issue of question "reliability" discussed in Chapter III).

Because of the low response rate, the entire survey sample was used to derive an average household use rate for each detention basin and edge development, rather than deriving separate use rates for each sample stratum (i.e., bayou of residence). Multiplying these average household rates by the total number of study area households yields an estimate of total demand for each development (columns A - C of Table 6). The total number of households was derived by dividing the 1980 census population of the study area (1,824,081) by the weighted mean number of persons per household (2.72) derived from the survey questionnaire.

Table 6. Recreation Demand and Carrying Capacity of Proposed Developments

Recreation Facility Development Location:	Total Recreation Days Demanded: Study Area Households		Mean Annual Household Use		Total Demand	Carrying Capacity
	A		B		C	D
Carpenters Bayou						
Edge Development	670,618	*	1.40	=	938,865	77,169
Brays Bayou						
Edge Development	670,618	*	6.79	=	4,553,496	390,708
Detention Area #1	670,618	*	3.98	=	2,669,060	411,352
Detention Area #2	670,618	*	3.55	=	2,380,694	388,612
Sims Bayou						
Detention Area #3	670,618	*	1.97	=	1,321,171	360,380
Greens Bayou						
Edge Development	670,618	*	3.33	=	2,233,158	551,953
Detention Area #4	670,618	*	1.96	=	1,314,411	175,953
Detention Area #5	670,618	*	1.35	=	905,334	248,531
Detention Area #6	670,618	*	1.35	=	905,334	350,732
Detention Area #7	670,618	*	1.35	=	905,334	175,366
Halls Bayou						
Edge Development	670,618	*	1.75	=	1,173,581	742,720
Hunting Bayou						
Edge Development	670,618	*	1.27	=	851,685	93,950
Little White Oak Bayou						
Edge Development	670,618	*	2.29	=	1,535,715	65,483
Totals:					**21,687,784**	**4,032,322**

Note: These demand estimates would typically be rounded to the nearest hundred or thousand for report purposes. Such rounding will not be used in this manual, however, so that the reader can better follow the presented calculations.

As indicated in Table 6, the total demand for the proposed developments is almost 22 million days of use. The 95% confidence interval is 15.5 million to 28.4 million days of use.[1] The interpretation of this confidence interval is that, if an infinite number of samples of the same size were taken, the aggregate use estimate would lie in this range 95% of the time. (See Volume II of the Recreation Manual Series for a more detailed discussion of the calculation and interpretation of confidence intervals.) It is unlikely that the proposed facilities could support this amount of use, and it was, therefore, necessary to estimate their recreation carrying capacity.

Carrying Capacity of Facilities. The maximum capacity of the proposed facilities was determined by use of TORP capacity standards. Shown below is a list of recreation (participation) day standards for the different facilities planned, adapted from pages 6 and A-12 of the 1985 Texas Outdoor Recreation Plan (TORP). These standards are for Texas Outdoor Planning Region 16, which includes the Houston study area.

Activity	Recreation Days Annually Per Facility Unit
Picnicking	1,137 per table
Playgrounds	17,667 per acre
Jogging Trails	74,432 per mile
Bicycling Trails	11,507 per mile
Walking Trails	26,274 per mile
Baseball	12,801 per field
Softball	18,516 per field
Football	11,572 per field
Soccer	43,908 per field
Boat/Canoe Ramp	5,141 per lane

The following adjustments to the above standards were made for the Houston analysis. The TORP standards for jogging, bicycling, and walking trails were combined into one weighted average standard for trail use, based upon the expected proportions of each of these three types of use for the trails planned (62.4% Jogging, 14.8% Bicycling, 22.7% Walking). The resulting average standard for the trails planned was 54,113 recreation days per mile, annually. Similarly, the TORP standards for use of playing fields for baseball, softball, football, and soccer were combined into one weighted average standard for field sports. This weighting was again done by multiplying the TORP standards by the expected proportions of use for each of the four types of sports fields

[1]These estimates assume that the responses to Question 9 were for total use per household. If the responses were use per household member, the estimate of total demand would be approximately 59 million days of use, with a 95% confidence interval of approximately 46 million to 72 million days of use.

being planned for (20.2% baseball, 41.0% softball, 5.3% football, 33.5% soccer). The resulting average standard for field sports was 25,486 recreation days per acre, annually.

The appropriate standards were multiplied by the number of respective facility item units planned for each bayou. The result was total annual additional recreation days, at capacity, to be added by the proposed recreation facility developments. The following example illustrates this process for Carpenter's Bayou, where only additional picnic tables and trails were proposed:

(6 Picnic Tables) * (1,137 Recreation Days per Table)	=	6,822
(1.3 Miles of Trails) * (54,113 Recreation Days per mile)	=	70,347
Total Recreation Days Added to Carpenter's Bayou	=	77,169

The results of these calculations are summarized in column D of Table 6. They indicate the carrying capacity of the proposed facilities is approximately 4 million recreation days, or about one fifth of the total estimated recreation demand of approximately 22 million recreation days. These results are not unusual for urban areas where the supply of recreation facilities is often much less than the existing demand. The results also support the needs projected in the TORP, and indicate the proposed facilities should be used at or near their capacity levels. Some substitution of use to new facilities from old facilities is possible, but is not likely to have a substantial net effect. Only 33.3 percent of the sample respondents indicated that they would reduce their use of other Houston area recreation facilities if the proposed recreation facilities are constructed. Some of the respondents to the survey may actually increase their use of recreation facilities in total.

CONTINGENT VALUATION RESULTS

Both the weighted (by income category to account for sampling bias) and unweighted results are presented below. As previously noted, the weighted results will provide more accurate population estimates and should be used. The unweighted results are only presented to illustrate the error that can result when biases in survey responses are not addressed.

Unweighted Results. Mean willingness-to-pay estimates for the entire recreation facility package as well as for individual components are reported in the first column of Table 7.[2] Each respondent was asked for a facility package value (Question 12, Appendix A) and also for an allocation of this value by project component (Question 14, Appendix A). The overall facility package

[2]Mean willingness-to-pay estimates for the entire facility package and individual components were also made by stratum (bayou of residence). These estimates are reported in the Galveston District Buffalo Bayou & Tributaries, Texas Feasibility Report.

value was $123.93 annually, with a 95% confidence interval of $114.90 to $132.96. When divided by the mean number of household members (2.93 from unweighted responses to Question 15, Appendix A), this amounts to $51.77 per household member. Mean estimates for individual components ranged from $4.10 annually (for Detention Area #6 in Greens Bayou) to $24.27 annually (for the Brays Bayou Edge Development).

Weighted Results. The same information was estimated using the income weighted sample responses and is presented in column 2 of Table 7. This adjustment reduced the overall mean value of the recreation facility package to $93.76 per year, with a 95% confidence interval of $85.37 to $102.15. Except for the Hunting Bayou Edge Development, similar reductions also result in the weighted estimates of mean values for individual facility components. For the Hunting Bayou Edge Development, the mean willingness-to-pay increased from $8.52 to $9.17 with weighting. In all cases, these weighted values are considered better estimates of the total population's mean values and are used in the remainder of the analysis.

ESTIMATED ANNUAL VALUE AT PLANNED CAPACITY

Facility capacity constraints limit the value from the previous CVM analysis that can be attributed to the proposed developments. That is, the respondents' total annual willingness-to-pay estimates are based on their perception of how often their households would be using the proposed facilities. As previously noted, the respondents estimated use of (demand for) the facilities greatly exceed the proposed facility carrying capacities. People would not be able, because of carrying capacity constraints, to use the facilities as often as they thought they could when estimating their "total willingness-to-pay." Therefore, rather than using the total willingness-to-pay estimates, a constrained benefit estimate must be derived. As described below, this constrained estimate was based on the proposed facility carrying capacities and the respondents' average willingness-to-pay per recreation day for each development component.

Table 7. Sample Means of Annual Willingness-to-Pay (Standard Error of Mean) (in June 1986 prices)

Facility Location - Component	Total Sample Mean Unweighted	Weighted
Carpenters Bayou - Edge Development	$ 6.05 (0.72)	$ 4.18 (0.52)
Brays Bayou - Edge Development	24.27 (1.64)	14.50 (1.37)
- Detention Area #1	23.04 (1.40)	14.38 (1.37)
- Detention Area #2	18.10 (2.45)	10.92 (1.39)
Sims Bayou - Detention Area #3	5.90 (0.60)	5.03 (0.57)
Greens Bayou - Edge Development	9.50 (0.92)	9.00 (0.97)
- Detention Area #4	7.88 (0.81)	7.28 (0.83)
- Detention Area #5	4.91 (0.47)	4.52 (0.49)
- Detention Area #6	4.10 (0.37)	3.74 (0.43)
- Detention Area #7	7.92 (2.70)	5.80 (1.79)
Hunting Bayou - Edge Development	8.52 (2.89)	9.17 (2.67)
Little White Oak Bayou - Edge Development	12.64 (2.83)	9.06 (1.98)
Total Package Mean	$123.93 (4.61)	$93.76 (4.28)
Mean Number of Household Members	2.93 (0.05)	2.72 (0.05)
WTP per Household Member	$51.77 (2.95)	$41.49 (2.06)

Using the Carpenters Bayou edge development as an example, the average willingness-to-pay per recreation day is estimated as follows. The average weighted annual willingness-to-pay for the Carpenters Bayou edge development is $4.18. This value is from the last column of Table 7 for the Carpenters Bayou edge development component. Dividing this value by the weighted mean number of persons per household (2.72 also from last column of Table 7) and the weighted mean number of recreation days of use per person per year these facilities would be used (1.40 from Table 6),[3] yields an average value per recreation day of $1.10. The carrying capacity of the Carpenters Bayou edge development facilities was previously estimated to be 77,169 recreation days (Table 6). Multiplying the carrying capacity by the average value per recreation day (77,169 x $1.10) yields the annual value of the Carpenter Bayou edge development, or $84,885.90. These results, as well as the results for the other development components are summarized in Table 8.

Table 8. Estimated Use and Value of Proposed Buffalo Bayou Recreational Facilities (in June 1986 prices)

Recreational Facility Development Location	Recreation Days Use Per Year	Value Per Recreation Day of Use	Annual Value
Carpenters Bayou			
Edge Development	77,169	$ 1.10	$ 84,886
Brays Bayou			
Edge Development	390,708	$ 0.79	$ 308,659
Detention Area #1	411,352	$ 1.33	$ 547,098
Detention Area #2	388,612	$ 1.13	$ 439,132
Sims Bayou			
Detention Area #3	360,380	$ 0.94	$ 338,757
Greens Bayou			
Edge Development	551,953	$ 0.99	$ 546,433
Detention Area #4	175,366	$ 1.37	$ 240,251
Detention Area #5	248,531	$ 1.23	$ 305,693
Detention Area #6	350,732	$ 1.02	$ 357,747
Detention Area #7	175,366	$ 1.10	$ 192,903
Halls Bayou			
Edge Development	742,720	$ 1.22	$ 906,118
Hunting Bayou			
Edge Development	93,950	$ 2.65	$ 248,968
Little White Oak Bayou			
Edge development	65,483	$ 1.45	$ 94,950
Totals:	4,032,322		$4,611,595

[3]Assuming here that the response to Question 9 was the number of days of use per person, rather than per household, provides a more conservative benefit estimate.

The results in Table 8 indicate an estimated value of about $4.6 million annually. This is based upon approximately four million recreation days of additional use to be provided by the planned facilities, at capacity. The 95% confidence interval is approximately $2.4 to $9.1 million, including the standard error of the estimates of person per household and use per person, as well as, for mean willingness-to-pay.

ADDITIONAL SURVEY RESULTS

As discussed in Chapters II and III, a secondary objective of the Buffalo Bayou survey was to identify Houston residents' preferences for recreational settings, facilities, activities, and experiences within the Buffalo Bayou Tributaries region. Some of this information was not needed specifically for the Buffalo Bayou benefit evaluation, but was collected to support other recreation planning efforts. This information included: respondent and household participation percentages for 25 outdoor recreation activities, the preferred psychological outcomes (motives) and the facility/service preferences for five different activity packages, and "other" facility/service preferences obtained from write-in responses. This additional planning information is summarized in Appendix B.

WHAT WAS LEARNED

Resource capability for facility development and facility capacities are key elements in calculating benefits. Existing capacity information for urban parks is limited and in need of future research. For this study, a secondary data source, the 1985 TORP Report was used. The TORP carrying capacity standards are for all of Region 16, and it is acknowledged that these could vary by Bayou sub-areas within the region. Many factors may enter into the determination of carrying capacities of these outdoor recreation facilities in an urban setting. Research should be directed toward a more thorough understanding of carrying capacity determination for outdoor recreation facilities.

The 1985 TORP Report was also used to estimate the needs for recreational activities in the Buffalo Bayou and its tributaries. However, the needs for particular subset populations can vary significantly from the total population. Different socio-economic conditions and characteristics of a given population of a particular stream can significantly influence the needs assessment for this subset population of the study area. The survey conducted in the study helped to establish these differences, but further research needs to be directed toward improved methods and ways to identify needs data in a timely, reasonable, and inexpensive manner. A survey questionnaire could include additional questions which will assist in development of more accurate needs assessment data for the specific study area.

Research is also needed to improve reliability of future intentions questions, such as those measuring potential use of

proposed facilities. This point was also raised in Chapter III, but the importance of it did not become as apparent until these data were used in the analyses described in this chapter.

ANNOTATED REFERENCES

1. US Water Resource's Council (1983) Economic Environmental Principles and Guidelines for Water and Related Land Resources Studies, U.S. Government Printing Office, Washington, D.C.

   The P&G provides a general discussion of alternative use and benefit estimation techniques. This includes a discussion of the "capacity" use estimation technique which is based on facility carrying capacities.

2. Moser, David A. and C. Mark Dunning (1986) "National Economic Development Procedures Manual - Recreation, Volume II, A Guide for Using the Contingent Value Methodology in Recreation Studies." IWR Report 86-R-5. U.S.Army Corps of Engineers Water Resources Support Center, Institute for Water Resources. Ft. Belvoir, Virginia.

   This report includes an excellent discussion of analyzing survey data, especially for contingent value surveys. Chapter II (Sampling for Contingent Value Estimates) which includes a discussion of computing means and confidence intervals from survey data and Chapter V (Analysis of Contingent Value Survey Data) are especially relevant.

3. Henry, Gary T. (1990), Practical Sampling, "Applied Social Research Methods Series, Volume 21," Sage Publications, Newbury Park, California.

   This is an excellent text on sampling, especially for the non-technical reader. Chapter 8, Postsampling Choices, includes a discussion of poststratification and other weighting procedures.

CHAPTER VI
REGIONAL MODELS

CONCEPTS AND OBJECTIVES

DEFINITION AND PURPOSE

Regional use estimation models are defined in the P&G as statistical models that relate recreation use to the relevant determinants (i.e, factors affecting use) based on data from existing recreation sites in the study area. Similarly, value estimation models are defined as statistical models of the relationships between the willingness to pay bid and selected characteristics of the site(s) and user populations. The primary purpose of these models is to explicitly test the effect of such factors as site attributes, substitutes, and population characteristics on individuals' demand for and value of alternative recreational opportunities. This is accomplished by collecting and analyzing cross sectional data from a series of existing or proposed sites, rather than from an individual site, as in a site specific application. (Note: Volume I, Recreation Use and Benefit Estimation Techniques, of this NED Procedural Manual - Recreation series, provides more detailed descriptions of the development and application of site specific and regional use estimation models.)

FEDERAL CRITERIA

As noted in the P&G, the application of regional models can provide for a more analytical evaluation and can economize on resources that would be required for site specific studies. The P&G not only encourages the development of regional models, but further states that if an applicable model has already been developed for a region in which a proposed project is to be located, it should be used.

The U.S. Water Resources Council (WRC) intended to develop, publish, and periodically update a list of available regional models that could be used to evaluate proposed projects. Because of organizational changes, the WRC has been unable to undertake these tasks. It has, however, provided guidelines and criteria that should be considered in model development and application. The WRC guidelines, originally published in the WRC Reference Handbook for fiscal year 1982, are provided below.

> Introduction or Purpose
>
> The purpose of these guidelines for recreation models is to encourage development of meaningful regional use and benefit estimating models consistent with the intent of the Procedures for Evaluation of National Economic Development Benefits and Costs (18 CFR 713, Part K). These guidelines should foster interagency cooperation in model development by providing a common set of criteria and characteristics of desirable regional models.

Nature of the Criteria

The criteria are based on the planning and evaluation information that models should provide rather than their detailed structural characteristics. This emphasis on model performance will permit innovation and flexibility in model design, choice of variables, data collection strategies, and development of recreation use estimates. Good estimating models, in general, are based on statistically sound methodologies, incorporate relevant variables, are replicable, and have predictive power. Specifically, regional recreation models should yield an empirical estimate of demand applied to the particular project or site based on: (1) socioeconomic characteristics of market area population; (2) qualitative characteristics and uniqueness of the recreation resources; and (3) costs and characteristics of substitute recreation opportunities. Models should permit generation of recreation use projections over time that vary with underlying determinants of demand, and allow for evaluation of gains and losses in the study area.

The model should reflect the effects of site congestion on the users' willingness to pay for the recreation opportunity and then be able to evaluate the possible long term effects of congestion on site characteristics.

Concept of the Region

The region must be determined by a combination of factors based on relevant activities (functional), types of recreation resources, geographical boundaries (spatial), geographic distribution of prospective recreation users, etc. A helpful step is to take into account existing or future sites that may be significant substitutes for the proposed site(s). Thus, the concept of the region, as defined in the NED Procedures, is not to use pre-established areas, but to define regions iteratively during the study as planners develop parameters for a cross section of sites and determine which are relevant to water related activities of the proposed sites. Planners should choose a sample containing a representative number of sites so that the variables will have predictive power.

Application of the Model

The model should be able to be applied to sites rather than to market areas because water resource planning is designed to produce changes at specific locations rather than to abstract area-wide markets of recreation goods and services. The estimates of value to be obtained from the model should be consistent with and of a level of precision similar to the estimates of value derived for other goods and services produced by a plan.

The procedures should be readily applicable to evaluating proposed changes on the availability of the specific recreation opportunities affected by the plans. For example, can the model estimate the benefit of an additional opportunity of a recreation activity at a particular location? Have questions concerning the relevant resources and sites been included in the household or similar surveys?

When meaningful to the resource situation being evaluated, the consideration of substitution should account for choices among (a) recreational and non-recreational activities, (b) alternative recreational activities, and (c) alternative sites for identical activities.

By following these guidelines, the regional recreation models developed by planners and researchers should be realistic in terms of their applicability to the water based recreation setting being evaluated.

VALUE ESTIMATOR MODELS

Value Estimator Models (VEM's) relate net economic value of a resource to changes in specific characteristics of a nonmarket commodity or to changes in user population characteristics. VEM's can be developed using ordinary least squares regression analysis or more sophisticated modelling techniques for close-ended CVM formats. In addition to models for annual value of recreation use, marginal willingness-to-pay values can be estimated for recreational activities.

Regressors. As argued elsewhere, regressors (or independent variables) selected for CVM bid functions and VEM's should be consistent with economic theory. Potential classifications of regressors include: (1) changes in nonmarket commodities; (2) cost variables; (3) household technology variables; (4) attitude and value variables; and (5) individual information set variables.

Recreationists combine variable and fixed inputs to "produce" recreational days. This production process is constrained by cost and household technology variables. Cost variables include the monetary cost and time cost of producing recreation days. The monetary costs of producing days are generally measured by the variable expenditures which are directly related to a recreation occurrence (e.g., day or trip). A large portion of these variable expenditures typically are travel costs. Because variable expenditures act as constraints on the household production process, variables which measure these expenditures, such as travel costs, may be relevant arguments for CVM bid functions (especially when use quantities are excluded from these funtions).

In addition to monetary costs, household production processes for recreational days are constrained by time costs. That is, time costs represent an opportunity cost from engaging in outdoor

recreation. Time costs are typically measured by travel time. Both out-of-pocket costs and the opportunity costs of time are potential regressors for CVM bid functions.

Attitudes and values impact CVM bid functions by causing systematic changes in tastes and preferences. Tastes and preferences impact the relative weight that consumers place on different characteristics of produced recreational activities and, therefore, willingness-to-pay for recreational activities. In some instances, it may be possible to measure attitudes and values by direct questioning. By and large, however, proxies have been used as indicators of attitudes and values. A commonly used indicator of attitudes and values (in addition to being a constraint) is income. For example, as income increases, leisure time may also increase. Also, as income increases, support (e.g., preference) for natural resource conservation may increase. Attitudes which are related to a general preference for outdoor recreational activities may be reflected in a number of variables. Such variables identified in previous studies include total days spent in all kinds of outdoor recreation per season or year, total variable expenditures on all kinds of outdoor recreational activities per season or year, total recreation days as a proportion of vacation days, and total recreation expenditures as a proportion of income.

The production processes for recreation days are constrained also by information. Differences in information across recreationists may lead to variations in willingness-to-pay. Recreationists obtain information from a number of sources which impacts the production of recreation days. These information sources include past experience, other recreationists, and literature. It is therefore conjectured that variables such as total years of participation, membership in outdoor clubs, and subscriptions to outdoor magazines may be relevant regressors for CVM bid functions and value estimator models(VEM's) for outdoor recreation facilities.

VEM Model Development. The primary objective of VEM function estimation is to obtain stable, reliable estimates of the structural parameters (i.e., regression coefficients). A stable coefficient is defined as a coefficient which remains relatively constant across alternative model specifications. That is, as the model is specified to include alternative variables, the estimated coefficients for key, policy related variables do not vary significantly.

For theoretical reasons, all model specifications should include quantity indicators (e.g., days), quality indicators, and income. Theory also suggests that VEM functions should include regressors which measure attitudes and values and information. From a conceptual standpoint, it is argued that the effects on willingness-to-pay of variables within each of these major

classifications are similar. Thus, alternative specifications can be tested using different combinations of variables from the quantity/quality, attitude and values, and information regressor categories. Alternative specifications should be evaluated on the basis of the stability of coefficients associated with proposed policies, theoretical plausibility of coefficient signs, t-values, and measures of goodness-of-fit. These criteria should be used to select a VEM specification which appears to estimate the most reliable relationship between willingness-to-pay and changes in policy related variables.

VEM Estimation. The dependent variable in a value estimating model is willingness-to-pay, measured by either a close-ended or open-ended question in the CVM questionnaire. At the present time, the superiority of the close-ended models versus open-ended models is unresolved in the literature, although the general tendency seems to be towards the former. Some have argued that close-ended bidding questions provide proper incentives for revelation of maximum willingness-to-pay. It has also been argued that close-ended bidding questions are more familiar to respondents because they closely resemble actual market bidding situations where consumers are faced with a "take it or leave it" valuation choice. Open-ended bidding questions, on the other hand, may be quite unfamiliar to recreationists. Hence, they may have difficulty providing accurate responses.

WHAT WAS DONE

As previously described, both an open-ended bid format and a close-ended (or dichotomous choice) approach were used in the Buffalo Bayou contingent valuation questionnaire. For the purpose of this study, the analysis of the open-ended bid format data produced the most appropriate results. A description of this analysis and the results obtained follows.

EXPLANATORY VARIABLES

The explanation of the actual variables considered and their expected relationships to willingness-to-pay are presented in Table 9. Each variable considered is described and grouped in the table according to the conceptual construct (i.e., the regressor category) it is intended to measure and the expectation regarding the direction of its influence upon willingness-to-pay. Each variable is also related back to the survey instrument (Appendix A) question from which it is derived. For example, the first three variables in Table 9 are measures of the perceived adequacy of existing facilities (the conceptual construct). The average miles now traveled for outdoor recreation (AVGTRAV) in the Houston area was requested in Question #3. It was hypothesized that the further people now have to travel the more they would be willing-to-pay for the proposed facilities, which might reduce their travel, and thus

the hypothesized, positive sign. Similar information is summarized in Table 9 for the remaining variables.

OLS EMPIRICAL ESTIMATES

A variety of ordinary least squares multiple regression models were estimated using the variable groupings presented in Table 9. Two models (based on different combinations of explanatory variables) were selected as the most appropriate based upon statistical fit and correspondence of estimated parameters with economic theory. Three functional forms (linear, double logarithmic, and semi-logarithmic) were estimated for each of these models. In all cases, these models were estimated using ordinary least squares statistical techniques and with the open-ended bid response for the entire proposed Recreation Facility Package as the dependent variable. The models are also based on the weighted sample data as previously discussed.

The linear functional form (Table 10) was very consistent in performance across both model specifications, both in terms of the stability of the regression coefficients and the variation explained. There was little variation in the coefficients of the four variables common to both models which were measures of: income (INCOME), education (SCHOOL), the perceived adequacy of existing facilities (AVGADEQ), and the close-ended offer from the question sequence (OFFR). All four variables were positively correlated with willingness-to-pay in both models. This positive relationship was expected for all of these variables. The perception of adequacy of existing facilities variable, AVGADEQ, has a positive coefficient, implying that the greater the perceived in-adequacy of existing facilities, the greater the willingness-to-pay for the proposed developments, which is an expected relationship.

Additional variables in model 1 include measures of the total estimated days the proposed facilities would be used (DAYS), the amount of recreation use that occurred in the Houston area in the previous year (RECDAYS), and whether or not the respondent was retired (RETIRED). In the linear functional form of this model (column 1 of Table 10), all of these variables were positively correlated with the willingness-to-pay measure. This was anticipated for the first two variables which are, respectively, measures of demand for the proposed facilities and an indicator of outdoor recreation preference or participation. However, it was anticipated that respondents who were retired would not be willing-to-pay as much as other individuals, which is not reflected by the positive coefficient. The RETIRED variable was, however, the only variable in the linear functional form of model 1 whose coefficient was not significant at least at the .10 level.[4]

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[4]Significance at the .10 level indicates 90% confidence that the regression coefficient is statistically different than zero.

Table 9. Variables Considered in Regional Modelling

Variable Name	Variable Definition	Questionnaire Questions	Conceptual Construct	Hypothesized Sign
AVGTRAV	Average miles traveled for outdoor recreation in the Houston area	Q-3	Adequacy of existing facilities	+
AVGADEQ	Average adequacy of outdoor recreation facilities in the Houston area	Q-4		-
SUBSTI	Whether respondent would decrease use of other recreation areas	Q-10		-
DAYS	Total estimated days of use for proposed recreation package facilities	Q-9	Use of new facilities	+
TOTLOC	Total number of proposed recreation facilities which will be used	Q-9		+
SCHOOL	Years of education	Q-21	Socioeconomic status and ability to pay	+
ETHNIC 1	Black race defined as a minority	Q-19		-
ETHNIC 2	All races other than caucasian defined as minority	Q-19		-
INCOME	Household income	Q-27		+
SPENDING	Outdoor recreation spending per week for household	Q-26	Outdoor recreation preferences	+
PSPENDIN	Annual outdoor recreation expenditures as proportion of household income			+
RECDAYS	Outdoor recreation days per person in the Houston area during the past year	Q-2		+
RETIRED	Whether household respondent is retired	Q-23		-
NATDEV	Preference for more developed detention park areas type facilities	Q-8	Willingness to pay for developed	+
NOTMOVE	Household respondent expects to live in Houston area 5 years from now	Q-25	Ability to use future facilities	+
ACCUR	Respondent confidence in willingness-to-pay response	Q-30	Decision task investment time	+
OFFR	Income reduction in close-ended bidding format	Q-11	Package cost for close-ended format and suggested value range for open-ended format	+

Table 10. Ordinary Least Squares Estimated Linear Models (Standard Error)

Independent Variable	Model 1	Model 2
INTERCEPT	-148.1402 (26.8906)***	-167.2258 (25.2153)***
INCOME	.0006 (.0002)***	.0008 (.0002)***
SCHOOL	9.3264 (1.4952)***	9.4280 (1.5178)***
AVGADEQ	7.8674 (4.6427)*	9.4078 (4.7353)**
OFFR	.3312 (.0335)***	.3314 (.0346)***
DAYS	.3255 (.1099)***	
RECDAYS	.1734 (.0679)***	
RETIRED	3.5815 (10.5835)	
PSPENDIN		469.6022 (132.2845)***
SUBSTI		16.2816 (8.9863)*
ACCUR		13.4987 (9.8616)
Number Observations	1115	1085
F-value	30.513***	28.327***
R^2	.16	.16
R^2 (Adjusted)	.16	.15

Additional variables in model 2 include measures of annual outdoor recreation expenditures as a proportion of household income (PSPENDIN), whether respondents would decrease use of other recreation areas with development of the proposed facilities (SUBSTI), and the respondents confidence in their willingness-to-pay responses (ACCUR). In the linear functional form of this model (column 2 of Table 10), these variables were, again, all positively correlated with the willingness-to-pay measure. This result was anticipated for the spending and perceived accuracy variables, but not for those transferring use from existing facilities. Except for ACCUR, all variables were significant at least at the .10 level.

As measured by the coefficient of determination (R^2), the linear models were also very consistent in terms of statistical fit, or explanatory power. The coefficient of determination indicates the amount of variation in the dependent variable, in this case willingness-to-pay, explained by the regression equation. The "adjusted" R^2 is a more precise measure accounting for the degrees of freedom lost by the number of variables in the regression equation. As measured by the adjusted R^2, the two linear models, respectively, explained 16 and 15 percent (Table 10) of the variation in the willingness-to-pay measure.

The double logarithmic functional form models are presented in Table 11. In this functional form, the dependent variable (annual household willingness-to-pay) and all continuous independent variables are specified in logarithmic form. The double logarithmic specification of model 1 had the best overall statistical fit (an adjusted R^2 of .24) of any of the models and specifications tested. The statistical fit of the double logarithmic functional form of model 2, however, was not quite as good as the two linear models. The significance of the overall regression equation and of the included variables is similar to the linear models presented in Table 10, and there is no clear reason for finding it to be preferable to the linear form specification.

The semi-logarithmic functional form models are presented in Table 12. In this functional form only the dependent variable is represented in logarithmic form. These models were less well fitting than the linear functional form models reported in Table 10, but only slightly so for model 1. Except for the ACCURATE variable in model 2, the signs of the variables were consistent with the other two functional forms. Again, there appears no strong reason for preferring this functional form over either of the other two.

Table 11. Ordinary Least Squares Estimated Double Logarithmic Models (Standard Error)

Independent Variable	Model 1	Model 2
INTERCEPT	-14.1014 (1.7297)***	-17.9762 (1.8207)***
Ln(INCOME)	.8976 (.1624)***	1.4146 (.1643)***
Ln(SCHOOL)	1.6933 (.4619)***	2.1986 (.4919)***
Ln(AVGADEQ)	1.0674 (.2964)***	1.3201 (.3127)***
Ln(OFFR)	.0889 (.1220)	.0792 (.1316)
Ln(DAYS)	.2638 (.0322)***	
Ln(RECDAYS)	.1956 (.0404)**	
RETIRED	.5137 (.2909)*	
Ln(PSPENDIN)		.4401 (.1212)***
SUBSTI		.6726 (.2373)***
ACCUR		.0247 (.2594)
Number Observations	1115	1085
F-value	51.886***	24.795***
R^2	.25	.14
R^2 (Adjusted)	.24	.13

Table 12. Ordinary Least Squares Estimated Semi-Logarithmic Models (Standard Error)

Independent Variable	Model 1	Model 2
INTERCEPT	-6.0233 (.7172)***	-4.2116 (.6838)***
INCOME	.00002 (.000006)***	.00003 (.000006)***
SCHOOL	.2115 (.0399)***	.2427 (.0408)***
AVGADEQ	.3705 (.1238)***	.4628 (.1272)***
OFFR	.0008 (.0009)	.0009 (.0009)
DAYS	.0104 (.0029)***	
RECDAYS	.0039 (.0189)**	
RETIRED	1.6626 (.2895)***	
PSPENDIN		9.8766 (3.7857)***
SUBSTI		.6886 (.2414)***
ACCUR		-.0632 (.2650)
Number Observations	1115	1085
F-value	28.320***	17.787***
R^2	.15	.10
R^2 (Adjusted)	.15	.10

Overall the signs of most variables meet the a priori expectations indicated in Table 9. Although none of these models fit the data exceptionally well, all models are highly significant and also in the range of fit often encountered in nonmarket valuation work using individual observations as data points. The linear functional form (Table 10) is most consistent in terms of statistical fit, and, as described below, most accurately estimates the mean willingness-to-pay of the survey data.

PREDICTED SAMPLE VALUES

The models were used to provide estimates of annual value for the Recreational Facility Package for the typical household in the study region. This was done by substituting the weighted average survey response for each of the independent variables in the regression equations presented in Tables 10 - 12 and solving for the estimated willingness-to-pay. The results are presented in Table 13 for all three functional forms of the two models previously described along with their 95% confidence intervals.

Table 13. OLS Models Mean WTP Estimates for Recreation Package (in June 1986 prices)

Model	Mean WTP Estimate	95% Confidence Interval	
		Lower Bound	Upper Bound
Model 1:			
Linear	$106.73	$84.59	$128.87
Double Log	30.23	18.47	50.17
Single Log	47.99	13.94	256.58
Model 2:			
Linear	$107.57	$84.07	$131.07
Double Log	20.60	11.04	38.97
Single Log	25.11	10.61	65.67

The values in Table 13 for the linear functional form are $106.73 and $107.57. The confidence intervals for these two estimates are within a range of $84 to $131. This compares with the weighted mean survey response of $94 which had a 95% confidence interval of approximately $85 to $102. The double logarithmic and semi-logarithmic functional forms result in significantly lower estimates of mean household value for the recreation facility package and also values which are considerably different from the means of the survey data. This leads to suspicion regarding the accuracy of the two logarithmic functional forms for estimating the annual household value of the proposed recreation facility package. The linear, weighted specifications are, therefore, considered more

appropriate, regardless of which is chosen, for estimating the annual household value for the facility package.

ADJUSTMENT OF MODELS FOR SUBSTITUTE SITE AVAILABILITY

A variety of variables were used in an attempt to measure the relative abundance of current park supply and its effect upon willingness-to-pay for recreation in the bayou areas. It was hypothesized that the availability of recreation opportunities would have an inverse relationship with the public's willingness-to-pay for additional provision of such areas. That is, the more park facilities currently available, the less the willingness-to-pay for the proposed developments. The variables used as candidates in an attempt to identify such an influence were:

1. Bayou park acreage as a percent of total bayou acreage:

   Bayou park acreage was determined from secondary sources and expressed as a percent of total bayou acreage. The data were obtained from the U.S. Army Corps of Engineers planning documents for the Buffalo Bayou Project region.

2. Log of Bayou park acreage as a percent of total bayou acreage:

   This variable is identical to #1 above except that the natural logarithm was used to allow for a nonlinear relationship between willingness-to-pay for recreation and current availability of recreation opportunities.

3. Distance weighted bayou park acreage as percentage of total bayou park acreage:

   This variable includes a distance weighted measure of the substitute recreation areas available in the adjacent bayou. The weight is a measure of distance from the center of the bayou of concern to the center of the nearest alternative bayou.

4. Bayou park acreage per capita in the bayou:

   Bayou park acreage was determined from secondary sources and divided by the population of the bayou. The data were obtained from the U.S. Army Corps of Engineers planning documents for the Buffalo Bayou Project region.

5. Log of Bayou park acreage per capita in the bayou:

   This variable is identical to #4 above except that the natural logarithm was to allow for a nonlinear relationship between willingness-to-pay for recreation and current availability of recreation opportunities.

The results of these estimations were judged unsuitable for use. In those few cases where any of the measures of the availability of substitutes were significant, the signs were opposite to those which one would expect. Generally it was concluded that, given the evidence of undersupply of recreation relative to population in the entire study region for which the original data had been collected, the supply measures were largely reflecting "noise" in the data set and not reflective of robust substitute recreation facility measures. In other study areas, variables of the type listed above should be considered in project analysis and recreation benefit measurement.

WHAT WAS LEARNED

The regional value estimating model effort was not very successful in terms of the amount of variation explained in the annual, household willingness-to-pay bids. This could have partially resulted from the relatively poor response rate received from the questionnaire, or the quality of the willingness-to-pay bids received.

Further studies are also needed to develop regional value estimating models which are better specified. This includes developing more and better measures of the conceptual constructs (types of variables) considered as independent variables in this modelling effort. Additional types of variables that might influence the value of urban recreation facilities should also be incorporated into future modelling efforts.

ANNOTATED REFERENCES

1. US Water Resource's Council (1983) Economic Environmental Principles and Guidelines for Water and Related Land Resources Studies, U.S. Government Printing Office, Washington, D.C.

   The document provides a detailed discussion of value estimating models and their development. It serves as a useful starting point from which to initiate the development of such models for urban recreation area benefits.

2. US Army Corps of Engineers (1986) National Economic Development Procedures Manual-Recreation, Volumes I and II, Institute for Water Resources, Reports 86-R-4 and 86-R-5, Water Resources Support Center, Casey Building, Fort Belvoir, Virginia.

   These reports provide a detailed discussion of procedures for estimating recreation benefits. The discussion includes basic issues relating to economics, benefit estimation, and value estimator models.

CHAPTER VII
FURTHER APPLICATIONS

There are three outputs from this case study description that planners may want to consider using in other applications: the mean use and value estimates that were estimated for Buffalo Bayou; the regional value estimation models; and the general data collection and analysis procedures. Following is a brief discussion of when the use of these outputs may be appropriate for other planning applications, as well as some of the constraints and qualifications that should be considered.

APPLYING MEAN USE AND VALUE ESTIMATES

Buffalo Bayou mean use and value estimates could be used for other urban recreation studies in the Houston area, or to other study areas similar to the Buffalo Bayou watershed. Caution should be used in doing this, however, particularly if the population of interest is obviously different from the Buffalo Bayou population. In these situations, the Buffalo Bayou mean values could be considered initial "unit day values" to be adjusted based on professional judgement using a point system similar to that provided in the P&G. Adjustments in price levels, using a Consumer's Price Index, should also be made to account for differences in price levels between the time of the Buffalo Bayou Study and the proposed application.

APPLYING VALUE ESTIMATION MODELS TO OTHER REGIONS

The regional value estimating models developed in the Buffalo Bayou study are shown and described in Chapter VI. These models may be applied in similar regional settings for estimating the annual value of <u>similar activity packages</u> for planning purposes. It <u>must</u> be remembered, however, the resulting household value estimates would be unconstrained, that is not limited by proposed facility capacities. If the anticipated demand (use) for the proposed facilities would exceed their carrying capacities, then similar adjustments, as used in the Buffalo Bayou Study would be required to derive a benefit estimate for planning purposes.

Variables included in the models can be used to statistically account for differences between the proposed regional and Buffalo Bayou settings, as opposed to just using professional judgement. For example, consider the linear model 2, previously presented in Chapter VI:

$$\begin{aligned} WTP = -167.2258 &+ .3314\ (OFFR) + 9.4078\ (AVGADEQ) \\ &+ 469.6022\ (PSPENDIN) + 9.428\ (SCHOOL) \\ &+ 16.2816\ (SUBSTI) + 13.4987\ (ACCURATE) \\ &+ .0008\ (INCOME) \end{aligned}$$

where, OFFR = Closed-ended offer amount preceding open-ended willingness-to-pay questionnaire question.

AVGADEQ = The average adequacy rating, on a 5 point scale, of the Buffalo Bayou region's existing facilities.

PSPENDIN = Annual outdoor recreation expenditures as a proportion of household income.

SCHOOL = Years of Education

SUBSTI = Whether Buffalo Bayou respondents would stop use, decrease use, or not change use of other areas because of proposed developments.

ACCURATE = Buffalo Bayou respondents' WTP accuracy rating, on a 5 point scale.

INCOME = Annual Household Income

Two variables in the above model that could almost always be changed to account for differences in the new region of application are SCHOOL and INCOME. The mean number of years of education and the mean household income of the population of adults in the region to which the model is applied could be substituted for the means for the Buffalo Bayou region. Means for the other variables could also be changed to account for differences in the new region, if appropriate information was available. Otherwise the following means obtained with the study questionnaire from the Buffalo Bayou sample would be used.

Variable	Mean Value
OFFR	193.659
AVGADEQ	2.815
PSPENDIN	0.027
SCHOOL	14.202
SUBSTI	0.405
ACCURATE	0.728
INCOME	27815.346

Mean estimated household annual willingness-to-pay for the proposed facility package in the region of application is obtained by plugging into the model the appropriate means for each independent variable, multiplying by the model's regression coefficients, and summing all products and the regression constant. Total annual value for the region is then obtained by dividing this mean estimate by mean number of persons per household, and

multiplying the result by the total population for the region. Again, it must be remembered that the resulting estimate would be an unconstrained estimate of the willingness-to-pay for a facility package, similar to those proposed for Buffalo Bayou.

REPLICATING BUFFALO BAYOU STUDY PROCEDURES

As described above, there may be some situations where planners could directly use the findings or models from the Buffalo Bayou Study in other planning studies addressing urban recreation developments. There are, however, many other potential applications where a new CVM study will be required. For these other applications, the discussions of the tasks completed for the Buffalo Bayou Study (Chapters II-V) and for regional modelling (Chapter VI) provide general guidance for the development and conduct of a CVM survey and analysis. Especially useful in these chapters are the discussions of how planning constraints can be addressed and accommodated and the listings of annotated references which provide sources for additional information.

When a CVM analysis is being considered for a particular study, information needs for other on-going or anticipated studies in the district or study area should be reviewed. It may be possible to combine study efforts or to identify some additional information needs that could be efficiently incorporated into the data collection and analysis. In some cases, expanding the study area and/or the types of resource settings being considered provides an opportunity to develop regional use and/or value estimation models. As previously noted, such models can provide, not only more precise and defensible use and value estimates, but also an analytical resource for future planning applications. In addition, combining study resources may make it possible to overcome specific study constraints, resulting in more efficient and effective data collection and analysis.

The process of conducting a CVM analysis and regional modelling is summarized in Chapters II-V and VI, respectively. As stated explicitly in several of these chapters and implicitly in others, the early and continued involvement of individuals other than the CVM analysts in this process is critical to its successful completion. In managing the overall effort, the study manager helps identify the types and timing of information needs and resources that can be devoted to the CVM analysis, and facilitates coordination with other members of the study team. Project designers help identify the types of natural and project resources that are being considered in the formulation of alternatives. Environmental resource and recreation planners help in identifying specific recreation and related natural resource developments (both existing and proposed), sources of needed data, and potential recreation related needs of the study area. Finally, other federal, state and local agencies can help in identifying recreation needs and opportunities, especially the types of

recreation developments that may obtain needed local support, and can serve as useful information sources in describing probable with- and without-project conditions.

Being a survey technique, successful application of the CVM method requires experience and expertise in such areas as survey design, sampling procedures for data collection, and statistical analysis such as regression procedures (especially for regional modelling) for data evaluation. Most Corps Districts have some expertise and experience in these areas. For example, partially because of their training, Corps sociologists are often a valuable resource for developing or reviewing survey questions. When additional expertise in these areas is required, it is usually readily available through cooperative agreements or contract resources.

What is unique about the CVM method is the development of the "contingent market" portion of the questionnaire. This portion of the questionnaire normally includes three parts: a scenario; a payment vehicle (method of payment); and, the payment question(s). The scenario is a careful and detailed description of the "good" (e.g., change in number or quality of recreation facilities) that the respondent is being asked to evaluate, and, therefore, the need for clear delineation of with- and without-project conditions. The payment vehicle is how the respondent will be charged, hypothetically, for the good (e.g., an entrance fee or a reduction in disposable income). Finally, a question or series of questions is asked to elicit how much the respondent is willing to pay for the good in question.

The importance of the design of the contingent market scenarios and questions to the overall success of the evaluation cannot be overemphasized. Districts which have not had experience with this type of questionnaire design are strongly encouraged to obtain some assistance when first undertaking a CVM analysis. Sources of such experience within the Corps include staff at the Institute for Water Resources, (preparers of the original Corps CVM Recreation Studies Guide, Volume II of this NED Manual Series), and Corps Districts which have successfully completed CVM studies. Sources outside the Corps include other agency and university personnel involved in CVM research and application.

APPENDIX A

SURVEY INSTRUMENT AND COVER LETTERS

The cover letters, post card, and questionnaire which are displayed in this appendix are not presented as a definitive model to be used for other studies. They represent the exact instrumentation used for the Buffalo Bayou survey, but, as stated in the "What Was Learned" section of Chapter III, more time should have been allowed for better development and testing of this questionnaire and accompanying letters and post card. The reader is referred to the discussion of questionnaire design principles in Chapter III, and to the annotated references at the end of that chapter for more detail and guidance.

INITIAL LETTER

TEXAS A&M UNIVERSITY

DEPARTMENT OF AGRICULTURAL ECONOMICS
COLLEGE STATION, TEXAS 77843-2124

Dear Citizen:

We need your help. We would like to know how you feel about the availability of outdoor recreation areas within the Houston area. In most instances, you have little opportunity to influence the character of these facilities prior to their provision. With this letter, we are giving you that opportunity. We would like to find out how you feel about several possible outdoor recreation alternatives.

Our focus, as researchers at Texas A&M University, is upon what types of outdoor recreational facilities you would like to see in the Houston area. We have been contracted by the U.S. Corps of Engineers and the National Park Service to perform an independent study to provide information for planning recreation facilities associated with flood control developments.

In an effort to provide useful high quality research, we ask you to please respond to the enclosed questionnaire. You were selected randomly from a list of Houston households. The reliability of this study depends upon you and others completing and returning this questionnaire. If you are unable to complete the entire questionnaire, please answer all the questions you can to the best of your ability and return the questionnaire.

If you would like a copy of a summary report when this study is complete, please write your name and address on a separate sheet of paper. Then enclose it in the return envelope along with your questionnaire, or send it separately if you desire. Confidentiality of your responses will be safeguarded. Completed questionnaires will be reviewed only by the research team at Texas A&M University. The number printed on the back of the questionnaire is only to eliminate your name from our mailing list when you respond.

Sincerely,

Allan Mills
Project Co-Director
Dept. of Recreation and Parks

John R. Stoll
Project Co-Director
Dept. of Agricultural Economics

Si usted habla español y no se siente comodo con el inglés, favor regresar este formulario en el sobre adjunto para nuevamente enviarle uno escrito en español.

Nombre _____

Dirección _____

_____

FOLLOW-UP POSTCARD

Last week a questionnaire seeking your opinion about the provision of recreation facilities in the Houston area was mailed to you.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If not, I would appreciate it if you would do so today. Because this questionnaire has only been sent to a sample of Houston area households, it is extremely important that yours also be included in the study. We would like our results to accurately reflect the viewpoint of Houston area households and provide reliable information for planning.

If by some chance you did not receive the questionnaire, or it got misplaced, please call collect (409-845-2335) and I will arrange to get another one in the mail to you today. [Si prefiere una copia en español, favor llamar por cobrar al (409-845-2335) para así enviarle hoy otra].

Sincerely,

John R. Stoll
Associate Professor and
Project Co-Director

TEXAS A&M UNIVERSITY

DEPARTMENT OF AGRICULTURAL ECONOMICS
COLLEGE STATION, TEXAS 77843-2124

FIRST FOLLOW-UP LETTER

April 11, 1984

Dear Citizen:

About three weeks ago we sent your household a questionnaire in an effort to learn more about your preferences for recreational facilities in Houston. As of today, we have not received your completed questionnaire.

We are conducting this study in order to obtain information about citizen desires for outdoor recreation facilities in the Houston area. Little information of this type is available at the present time. This means that recreation planners may be seriously misinformed about the desires of citizens for outdoor recreational facilities. If so, this could lead to poor decisions regarding the provision of new and management of existing Houston area recreation facilities.

We are writing to you again because, if our results are to be reliable and useful, it is important that each questionnaire be completed and returned. In the event that your questionnaire has been misplaced, a replacement is enclosed. (La razón por la cual le estamos escribiendo nuevamente es porque si queremos que los resultados sean útiles y confiables, es importante que cada cuestionario sea llenado completamente y regresado. Si por alguna razón su cuestionario se ha extraviado, adjunto encontrará otro.

If you would like a copy of a summary report of this study when it is completed, please tear off the form below and fill it out. Then enclose it along with your questionnaire or send it in a separate envelope to Dr. John R. Stoll. Regardless of how you return this form, your name will never be used to identify your responses. Confidentiality of all responses will be strictly maintained.

Your cooperation is greatly appreciated.

Sincerely,

John R. Stoll
Associate Professor and
Project Co-Director

Si usted prefiere la copia de este cuestionario en español, favor de llamar a cobrar al teléfono 409-845-2335.

_____ Yes, I would like to receive a copy of a summary report for the outdoor recreation facility study.

Name _____

Address _____

_____

TEXAS A&M UNIVERSITY

DEPARTMENT OF AGRICULTURAL ECONOMICS
COLLEGE STATION, TEXAS 77843-2124

SECOND FOLLOW-UP LETTER

April 11, 1986

Dear Citizen:

About six weeks ago we sent you a questionnaire asking for your help in an effort to learn more about outdoor recreation in the Houston area. We have not yet received your completed questionnaire.

So far the number of questionnaires returned is encouraging. But to accurately describe citizen desires, we need information from you and the others who have not yet responded. Our past experience suggests that people who have not yet responded may represent significantly different portions of the population than those who have already responded.

We are conducting this study in order to determine how to better satisfy the outdoor recreation desires of Houston area citizens. Because little information is available, recreation planners may be seriously misinformed about the desires of citizens for recreation facilities and opportunities in the Houston area. This could lead to decisions which inadequately consider your preferences. For this reason, I am sending this by certified mail to insure delivery. In case our other correspondence did not reach your household, a replacement questionnaire is enclosed. Please complete this questionnaire and return it in the enclosed postage-paid envelope.

If you would like a copy of a summary report, please tear off the form on the bottom of this sheet and fill it out. Then send it with your questionnaire or in a separate envelope to Dr. John R. Stoll. Regardless of how you return *this form*, *your name* will never be used to identify your responses. Confidentiality of all responses will be strictly maintained.

Your cooperation in making this study a success is appreciated.

Sincerely,

John R. Stoll
Associate Professor and
Co-Project Director

Hace como seis semanas le enviamos un cuestionario pidiendole su ayuda para aprender un poco mas sobre el entretenimiento al aire libre en el area de Houston. Hasta el momento no hemos recibido su cuestionario. Si usted prefiere que la copia de este cuestionario sea en espanol, favor de llamar por cobrar al te.efono number 409-845-2335.

_____ Yes, I would like to receive a copy of the summary report of this outdoor recreational facility study.

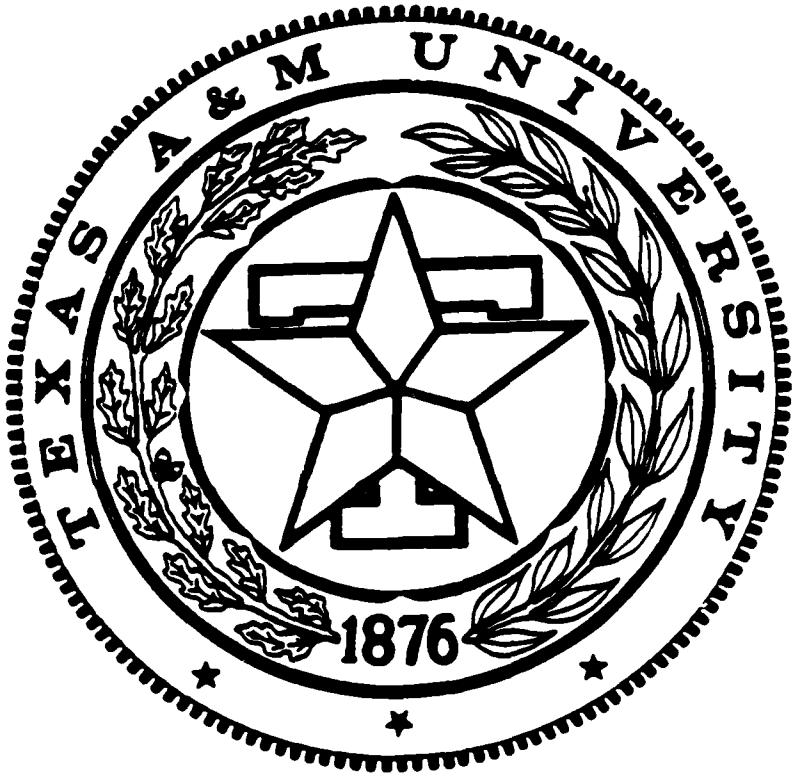
Name _____

Address _____

_____

OMB #0702-0016
Approval expires 10/31/86

OUTDOOR RECREATION SURVEY



CONDUCTED BY

Texas A&M University
Department of Agricultural Economic
and
Department of Recreation and Parks

You have been randomly selected to receive this questionnaire. All information is confidential. The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off our mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

Please return the completed questionnaire to Dr. John R. Stoll in the self-addressed envelope provided.

In this first section of the questionnaire we would like to ask you some questions about the outdoor recreation activities your household participated in during the past 12 months. Please include only activities which took place away from your home.

Q- 1 For each of the recreational activities listed below, please indicate in section A whether you did or did not participate in it during the previous 12 months. Then, in section B indicate whether any other member of your household participated in it during the previous 12 months. (Circle one response for each row of sections A and B)

RECREATIONAL ACTIVITY	SECTION A: YOU PERSONALLY PARTICIPATED		SECTION B: OTHER HOUSEHOLD MEMBER PARTICIPATED	
Visited a park?	YES	NO	YES	NO
Used a playground?	YES	NO	YES	NO
Swam in a pool?	YES	NO	YES	NO
Went jogging/running/walking?	YES	NO	YES	NO
Participated in outdoor nature programs?	YES	NO	YES	NO
Bicycled for pleasure or exercise?	YES	NO	YES	NO
Used facilities for handicapped individuals?	YES	NO	YES	NO
Visited art or historical facilities?	YES	NO	YES	NO
Used exercise equipment?	YES	NO	YES	NO
Played basketball outdoors?	YES	NO	YES	NO
Played tennis?	YES	NO	YES	NO
Played baseball?	YES	NO	YES	NO
Played softball?	YES	NO	YES	NO
Played volleyball?	YES	NO	YES	NO
Played football?	YES	NO	YES	NO
Played soccer?	YES	NO	YES	NO
Played golf?	YES	NO	YES	NO
Went bird watching?	YES	NO	YES	NO
Went picnicking?	YES	NO	YES	NO
Went horseback riding?	YES	NO	YES	NO
Went boating or canoeing on rivers or lakes?	YES	NO	YES	NO
Went fishing?	YES	NO	YES	NO
Went skateboarding?	YES	NO	YES	NO
Visited outdoor scenic places?	YES	NO	YES	NO
Used undeveloped open space for activities?	YES	NO	YES	NO

Now we would like to ask you for some specific information about your participation in outdoor recreation within the Houston area. Please take a moment to think about each question and then respond as accurately as you can.

Q- 2 Please tell us the average number of days that you or members of your household participated in each of the following five types of activities in or around the Houston area during the past 12 months. (Please provide the best estimate you can and write "0" in blanks when no one participated in a specific type of recreation)

AVERAGE NUMBER OF DAYS PER PERSON	AVERAGE NUMBER OF HOUSEHOLD MEMBERS PER OCCASION
_____ DAYS PICNICKING	_____ HOUSEHOLD MEMBERS
_____ DAYS USING PLAYGROUNDS	_____ HOUSEHOLD MEMBERS
_____ DAYS USING TRAILS	_____ HOUSEHOLD MEMBERS
_____ DAYS PLAYING FIELD SPORTS	_____ HOUSEHOLD MEMBERS
_____ DAYS USING UNDEVELOPED OPEN SPACE	_____ HOUSEHOLD MEMBERS

Q- 3 How far did members of your household usually travel to participate in each recreation activity in the Houston Area? (Specify to nearest 1/4 mile

_____ MILES FOR PICNICKING (one-way distance)
_____ MILES FOR USING PLAYGROUNDS (one-way distance)
_____ MILES FOR USING TRAILS, e.g., jogging, running, or walking (one-way distance)
_____ MILES FOR FIELD SPORTS, e.g., football, softball, or soccer (one-way distance)
_____ MILES FOR USING UNDEVELOPED OPEN SPACE, e.g., watching wildlife, observing nature, and enjoying scenic views (one-way distance)

Q- 4 How adequate do you feel the supply of facilities is for each type of recreation in the Houston area? (Circle one response for each row)

	VERY ADEQUATE	SOMEWHAT ADEQUATE	NEUTRAL	SOMEWHAT INADEQUATE	VERY INADEQUATE
PICNICKING	VA	SA	N	SI	VI
USING PLAYGROUNDS	VA	SA	N	SI	VI
USING TRAILS	VA	SA	N	SI	VI
PLAYING FIELD SPORTS	VA	SA	N	SI	VI
USING OPEN SPACE	VA	SA	N	SI	VI

Q- 5 Look back at your responses to question Q-2. In which of the five types of recreational activities was the average number of days per person highest during the previous 12 months? (If two or more activities are tied for the most days, write the name of the one you prefer most.)

_____ TYPE OF RECREATIONAL ACTIVITY

Q- 6 In this question we would like to know how IMPORTANT you feel each of the following reasons are for you personally when making your decision whether to participate in the type of recreation within the Houston area which you wrote on the blank above for question Q-5. (Please circle one response for each item)

REASONS	VERY IMPORTANT	SOMEWHAT IMPORTANT	NEUTRAL	SOMEWHAT UNIMPORTANT	VERY UNIMPORTANT
To be close to nature	VI	SI	N	SU	VU
To experience new and different things	VI	SI	N	SU	VU
To experience tranquility	VI	SI	N	SU	VU
To help release or reduce some built up tensions	VI	SI	N	SU	VU
To have a change from your daily routine	VI	SI	N	SU	VU
To do something with your family	VI	SI	N	SU	VU
To feel your independence	VI	SI	N	SU	VU
To have thrills	VI	SI	N	SU	VU
To improve your skills	VI	SI	N	SU	VU
To feel isolated	VI	SI	N	SU	VU
To relax physically	VI	SI	N	SU	VU
To be where things are fairly safe	VI	SI	N	SU	VU
To take risks	VI	SI	N	SU	VU
To get exercise	VI	SI	N	SU	VU
To be away from crowds of people	VI	SI	N	SU	VU
To be near others who could help if you need them	VI	SI	N	SU	VU
To get away from the heat	VI	SI	N	SU	VU
To get over feeling depressed or unhappy	VI	SI	N	SU	VU

Q- 7 In this question we would like to know how NECESSARY you feel each of the following facility items are to you personally when making your decision about where to participate in the type of recreational activities within the Houston area which you wrote on the blank for question Q-5. (Please circle one response for each item)

FACILITY ITEMS	VERY NECESSARY	SOMEWHAT NECESSARY	NEUTRAL	SOMEWHAT UNNECESSARY	VERY UNNECESSARY
Picnic tables	VN	SN	N	SU	VU
Water fountains	VN	SN	N	SU	VU
Grills or barbecue pits	VN	SN	N	SU	VU
Refuse dump (garbage) containers	VN	SN	N	SU	VU
Electrical outlets	VN	SN	N	SU	VU
Gate attendant	VN	SN	N	SU	VU
Parking lot	VN	SN	N	SU	VU
Night lighting	VN	SN	N	SU	VU
Paved access roads	VN	SN	N	SU	VU
Nature hiking trails	VN	SN	N	SU	VU
Restrooms	VN	SN	N	SU	VU
Trees and natural vegetation	VN	SN	N	SU	VU
Canoe or small boat facilities	VN	SN	N	SU	VU
Playground equipment	VN	SN	N	SU	VU
Concessions	VN	SN	N	SU	VU
Bicycle trails	VN	SN	N	SU	VU
Skateboard paths	VN	SN	N	SU	VU
Exercise/fitness equipment	VN	SN	N	SU	VU
Facilities for handicapped people	VN	SN	N	SU	VU
Information/route signs	VN	SN	N	SU	VU
Grass/open turf areas	VN	SN	N	SU	VU
Trails for walking	VN	SN	N	SU	VU
Jogging/running trails	VN	SN	N	SU	VU
Benches to sit on	VN	SN	N	SU	VU
Flowers	VN	SN	N	SU	VU
Fencing/safety fencing	VN	SN	N	SU	VU
Other (Please specify) _____	VN	SN	N	SU	VU
_____	VN	SN	N	SU	VU

In this section we would like to ask you about a specific set of recreational facilities which is being considered

Flood control is a concern in the Houston area because of land subsidence (sinking over time) and drainage problems in this relatively flat but highly developed urban area. A variety of proposals are currently being considered for prevention of flood damages in the Houston region. If these proposals are approved, there will be opportunities for federal, state, and local authorities to provide new recreational facilities while carrying out the proposals. But to do so, they will need to know where and what types of recreational facilities should be supported.

Different recreational activities require development of different types of facilities. Some facility developments may include ballparks, soccer fields, and tennis courts while others may be used more often for trail walking, wildlife observation, and bicycling. There are two types of recreational developments which are possible additions to Houston area flood control projects; bayou-edge trailways and flood detention areas. Detention areas are large land areas next to a specific bayou. The detention areas would be designed to allow portions of their land area to be flooded during periods of heavy rainfall. This means that during some portions of the year, usually short periods after heavy rains, parts of these areas may be partially flooded. But during the remainder of the year a variety of recreational activities could be supported, e.g., baseball softball, soccer, tennis, etc. In addition to these field sport activities, a variety of other activities would be possible. Thus, the proposed detention areas in the Houston area would actually be a type of urban park. These parks would range in size from 52 to 312 acres. Each would be suitable for a variety of recreational activities but a major distinction could be made between those that are essentially natural (see Figure A in the foldout on the next page) and those that are more highly developed (see Figure B in the foldout on the next page).

Bayou-edge trailways development could include such things as picnic tables, benches, trees and playgrounds. Their primary characteristic, however, would be that each would have some sort of trail (see Figure C in the foldout on the next page) for bicycling, jogging, or walking.

Q- 8 For your household, if detention park areas like those shown in Figures A and B were to be provided, would you prefer they be: (Circle number)

1 MORE NATURAL AS IN FIGURE A
2 MORE DEVELOPED AS IN FIGURE B

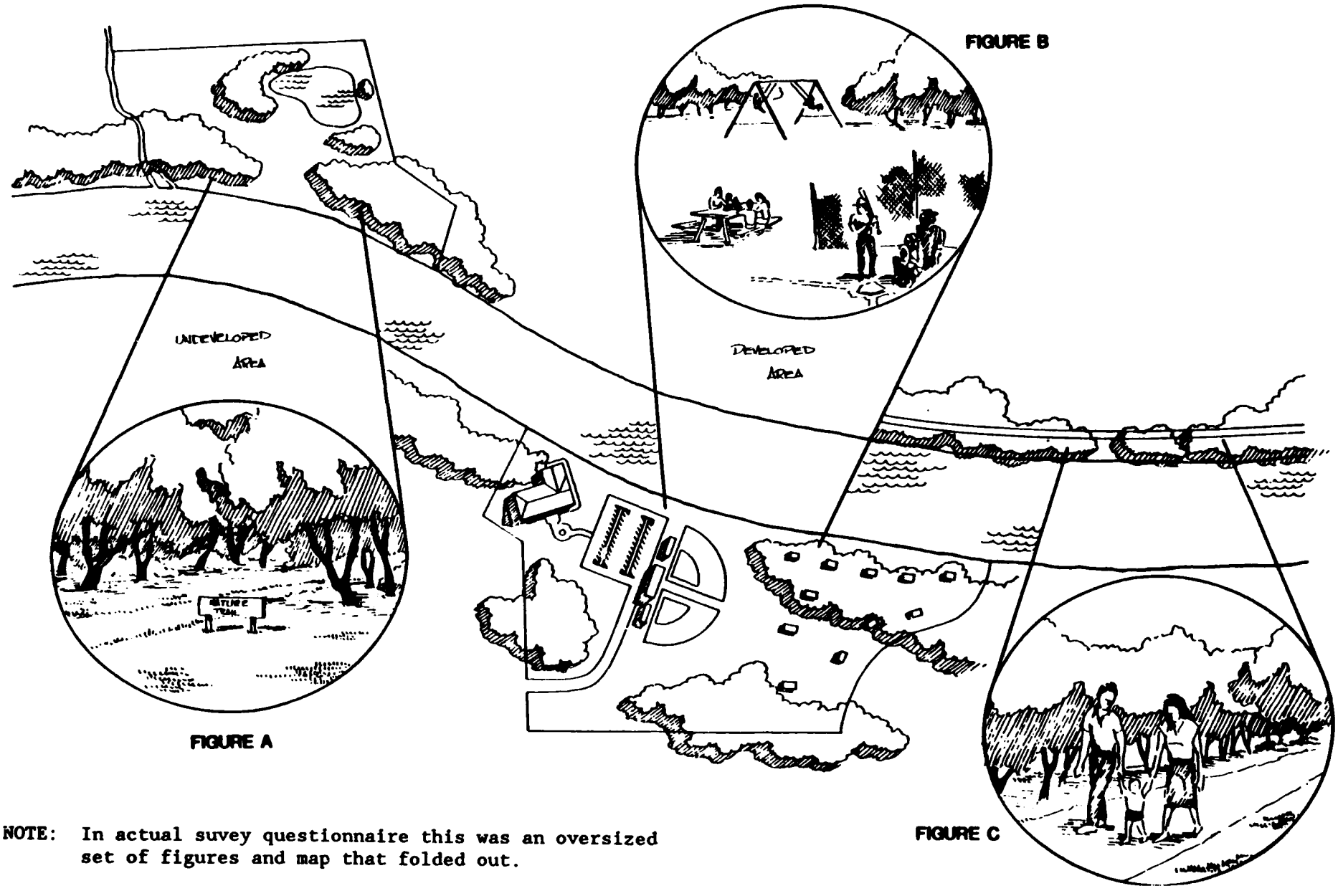
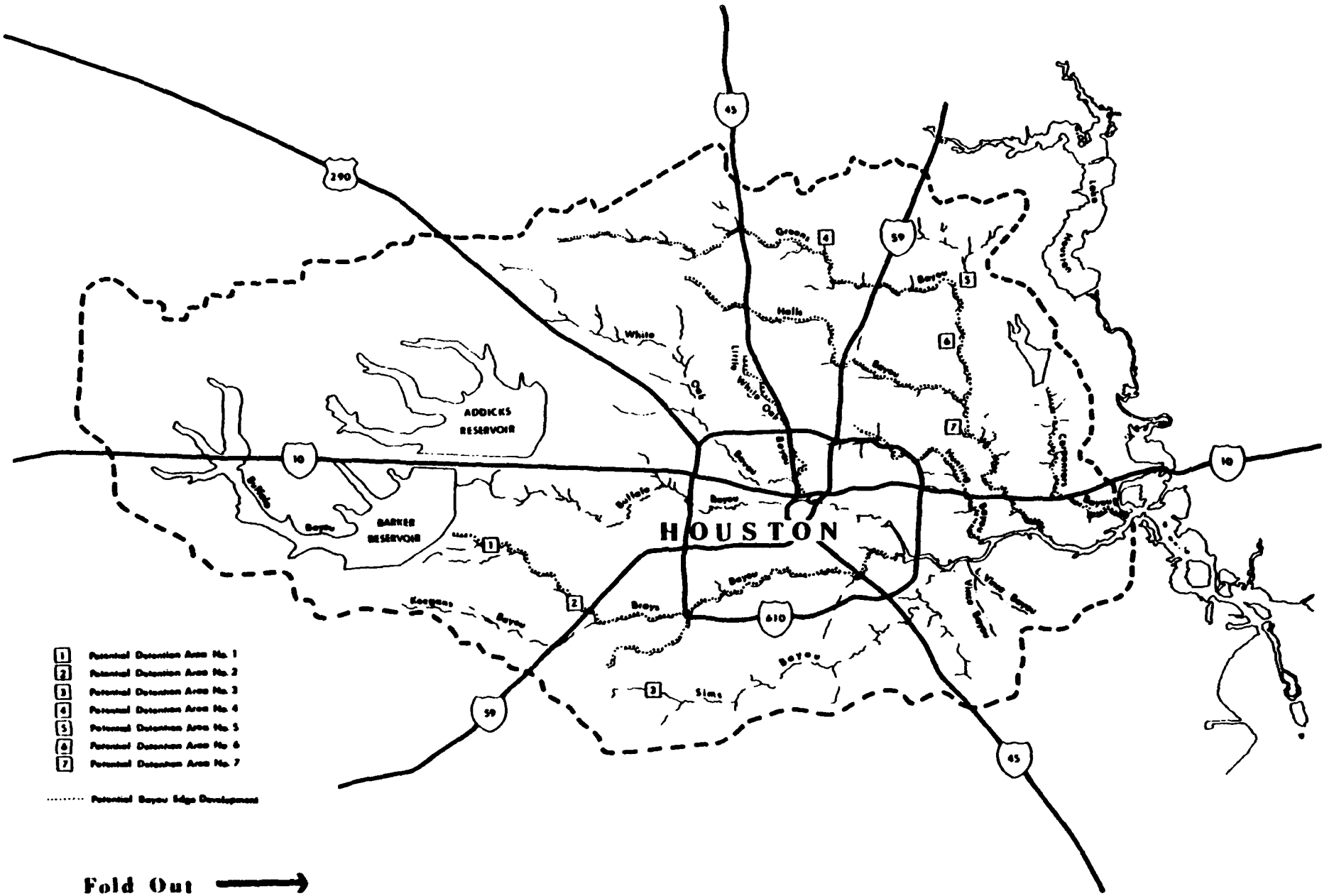


FIGURE A

FIGURE B

FIGURE C

NOTE: In actual suvey questionnaire this was an oversized set of figures and map that folded out.


HOUSTON
ADDICKS RESERVOIR
BARKER RESERVOIR
290
45
59
10
610
White Oak
Little White Oak
Halls
Greens
Buffalo
Brays
Sims
Hunting
Cypress
Vince
1 Potential Detention Area No. 1
2 Potential Detention Area No. 2
3 Potential Detention Area No. 3
4 Potential Detention Area No. 4
5 Potential Detention Area No. 5
6 Potential Detention Area No. 6
7 Potential Detention Area No. 7
Potential Bayou Edge Development

Fold Out ⟶

Q- 9 Notice, on the foldout at the left, there is a map of the Houston area. This map shows highways as well as the major bayous included in the Houston region. Along some of the Houston area bayous on the map there are heavily dotted lines. These lines show the location of potential recreation trailways which could be built along with planned flood control developments. Along each bayou there are also boxes with numbers in them. These numbers show the potential location of seven flood detention areas (or urban parks) which would also support recreational activities if the flood control plans currently being considered are in fact adopted.

In Section A, please circle YES or NO for each of the Bayou-edge and Detention Park area locations listed to indicate whether members of your household would likely use it for recreation during a typical year. Then, for each YES, in Section B write in your estimate of the number of days per year your household would use each of the two types of potential recreation developments.

LOCATION	SECTION A: WOULD YOUR HOUSEHOLD USE EACH? (circle)		SECTION B: HOW MANY DAYS PER YEAR AT — BAYOU EDGE DEVELOPMENT LIKE FIGURE C: # DAYS	SECTION B: HOW MANY DAYS PER YEAR AT — DETENTION PARKS LIKE FIGURES A AND B: # DAYS
Brays Bayou				
Bayou-Edge Development	YES	NO		
Detention Area Number 1 (312 Acres)	YES	NO		
Detention Area Number 2 (190 Acres)	YES	NO		
Carpenters Bayou				
Bayou-Edge Development	YES	NO		
Greens Bayou				
Bayou-Edge Development	YES	NO		
Detention Area Number 4 (80 Acres)	YES	NO		
Detention Area Number 5 (163 Acres)	YES	NO		
Detention Area Number 6 (53 Acres)	YES	NO		
Halls Bayou				
Bayou-Edge Development	YES	NO		
Detention Area Number 7 (52 Acres)	YES	NO		
Hunting Bayou				
Bayou-Edge Development	YES	NO		
Little White Oak				
Bayou-Edge Development	YES	NO		
Sims Bayou				
Detention Area Number 3 (296 Acres)	YES	NO		

Q-10 If you or your household members began using one of these recreation areas, would they be likely to change their use of another area they currently use? (Circle number)

1 STOP USING ANOTHER AREA
2 DECREASE USE OF ANOTHER AREA
3 NO CHANGE IN USAGE OF OTHER AREAS

Q-11 As you know, all packages of recreational facilities cost money to provide. Often the costs of providing these facilities are difficult to recognize. But whether you see them clearly or not, these costs are paid by you. Sometimes there are direct fees for use of recreation areas and other times you may pay indirectly through increases or reallocation of the tax dollars you contribute to local, state, and federal entities or through changes in prices of certain goods and services. In the end, you and other citizens do pay for these facilities. In one way or another, your household's annual income is reduced.

Suppose the entire package of bayou-edge trailways and detention park areas shown in the map could be provided, if your household's income were reduced by $ 75 per year. Would you approve of this new reduction in your annual income rather than not have these outdoor recreation facilites provided? (Circle number)

1 YES
2 NO

Q-12 What is the highest amount you would allow your household's annual income to be reduced in order to obtain these outdoor recreation facilities, rather than do without them?

_____ DOLLARS PER YEAR

Q-13 If your answer to Q-12 above was "0", please choose the statement below which best describes your reason for not allowing a reduction in your household's annual income. (Circle only one number)

1. THERE ARE CURRENTLY PLENTY OF OTHER RECREATIONAL FACILITIES IN HOUSTON
2 I OBJECT TO PAYING FOR RECREATION FACILITES
3 THAT IS WHAT THESE RECREATIONAL FACILITIES ARE WORTH TO ME
4 NOT ENOUGH INFORMATION WAS PROVIDED TO MAKE A DECISION

Q-14 In question Q-12 you stated the highest income reduction your household would accept rather than do without the Houston area recreation facility package. There are 7 bayous in the package described, 6 of which would have bayou-edge trailways development; and 7 detention park areas are along these bayous. How would you allocate (divide up) your monetary response to question Q-12 among each of these parts of the recreation package?

	AMOUNT ALLOCATED
Brays Bayou:	
Bayou-Edge Development.....	$ _____
Detention Area Number 1 (312 Acres).....	$ _____
Detention Area Number 2 (190 Acres).....	$ _____
Carpenters Bayou:	
Bayou-Edge Development.....	$ _____
Greens Bayou:	
Bayou-Edge Development.....	$ _____
Detention Area Number 4 (80 Acres).....	$ _____
Detention Area Number 5 (163 Acres).....	$ _____
Detention Area Number 6 (53 Acres).....	$ _____
Halls Bayou:	
Bayou-Edge Development.....	$ _____
Detention Area Number 7 (52 Acres).....	$ _____
Hunting Bayou:	
Bayou-Edge Development.....	$ _____
Little White Oak:	
Bayou-Edge Development.....	$ _____
Sims Bayou:	
Detention Area Number 3 (296 Acres).....	$ _____

NOTE: Total allocated should equal response to Q-12. $ _____

In order to analyze the responses we get from people responding to this survey, we need to ask a few questions about you and your household. Your answers will be kept completely confidential.

Q-15 How many people live in your household, including yourself? (Please specify)

_____ PEOPLE

Q-16 How many of the household members identified in Q-15 are children, 17 years old or younger? (Please specify)

_____ CHILDREN 17 AND UNDER

Q-17 What is your present age? (Please specify)

_____ YEARS

Q-18 When did you first begin living in Texas? (Circle one number)

1 I WAS BORN HERE
2 BEFORE 1974
3 DURING 1974 - 1979 PERIOD
4 DURING 1980 - 1986 PERIOD

Q-19 Which of the following race/ethnic groups describes you best? (Circle only one number)

1 ASIAN
2 BLACK
3 HISPANIC
4 WHITE
5 OTHER (Please specify) _____

Q-20 I am:

1 FEMALE
2 MALE

Q-21 What was the last year of school you completed? (Circle one number)

Grade School	High School	College/Technical	Graduate School
1 2 3 4 5 6 7 8	9 10 11 12	13 14 15 16	17 18 19 20 21+

Q-22 Which of the following statements best describes you? (Circle one number)

1 SINGLE AND NOT HEAD OF HOUSEHOLD
2 SINGLE AND HEAD OF HOUSEHOLD
3 MARRIED AND NOT HEAD OF HOUSEHOLD
4 MARRIED AND HEAD OF HOUSEHOLD

Q-23 Are you retired?

1 YES
2 NO

Q-24 Where you now live, do you:

1 RENT
2 OWN
3 OTHER

Q-25 Do you plan to live somewhere in or near Houston five years from now? (Circle one number)

1 YES
2 NO

Q-26 About how much money would you estimate that your household spends on all kinds of outdoor recreation, in an average week? (Please specify dollar amount)

_____DOLLARS PER WEEK

Q-27 Please circle the one number below which best describes your total household income. Think of total income before taxes for you and for all members of your household during the previous 12 months. Note: If you are uncertain, what is your best guess? (Circle only one number)

1 Less than $10,000
2 $ 10,000 - $ 19,999
3 $ 20,000 - $ 29,999
4 $ 30,000 - $ 39,999
5 $ 40,000 - $ 49,999
6 $ 50,000 - $ 59,999
7 $ 60,000 - $ 69,999
8 $ 70,000 - $ 79,999
9 $ 80,000 - $ 89,999
10 $ 90,000 - $ 99,999
11 $100,000 - $109,999
12 $110,000 - $119,999
13 $120,000 - $129,999
14 $130,000 or more

Q-28 Was your household income during the previous 12 months: (Circle one number)

1 About the same as in other recent years?
2 Much higher than in other recent years?
3 Much lower than in other recent years?

To help us in the design of future questionnaires and in assessing the quality of our data for this study, could you please take a minute to complete the following:

Q-29 Overall, how understandable did you find the wording of the questions? (Circle one number on the following scale)

VERY CLEAR	CLEAR	MODERATE	UNCLEAR	VERY UNCLEAR
2	1	Ø	-1	-2

Q-3Ø How accurate do you feel your answers were to the questions about your willingness to allow income reductions in return for recreation facilities? (Questions Q-11 and Q-12)

VERY ACCURATE	ACCURATE	MODERATE	INACCURATE	VERY INACCURATE
2	1	Ø	-1	-2

THANK YOU FOR YOUR HELP!

We welcome your comments concerning recreational activities, the availability of recreation facilities in the Houston area, or this questionnaire. Feel free to write below or on the back of this questionnaire booklet.

APPENDIX B

RECREATION ACTIVITY PARTICIPATION, MOTIVATIONS, AND FACILITY PREFERENCES

APPENDIX B

RECREATION ACTIVITY PARTICIPATION, MOTIVATIONS, AND FACILITY PREFERENCES

One purpose of the Buffalo Bayou recreation survey was to collect information on activity participation, motivations for activity participation, and desired facilities and services associated with these activities. This information was collected not only for the Buffalo Bayou application, but also to assist Galveston District recreation planners in designing appropriate activity settings and developments for other planning studies. Although the data were collected from the Houston area, they may also provide insight into motivation and facility/services preferences for other areas.

ACTIVITY PARTICIPATION

Question # 1 in the questionnaire asked respondents whether or not they or other members of their households had participated in each of 25 different outdoor recreation activities during the previous twelve months (Table B-1). The 25 types of activities included in this question were selected on the basis of preliminary meetings with all members of the Corps study team.

Activity participation was indicated by a majority of the Houston respondents for both themselves and other household members for visiting a park (80.2%), visiting outdoor scenic places (74.5%), jogging/running/walking (71.9%), picnicking (64.0%), and visiting art or historical facilities (62.6%). Less than fifty percent of the respondents indicated that they themselves participated in each of the other twenty activities listed. However, for three of these other activities, over 50% of the respondents indicated that other members of their households did participate. These three other activities were using a playground (56.7%), bicycling for pleasure or exercise (53.6%), and swimming in a pool (53.3%).

Table B - 1. Percentages of "YES" Responses to Items in Question # 1 Asking About Participation in 25 Activities by the Respondents Themselves and by Other Members of Their Households (Items Ranked by "YES" Percents)

ITEMS	Respondent Percentage	Other Household Members
Visited a park	80.2%	81.5%
Visited outdoor scenic places	74.5%	70.9%
Went jogging/running/walking	71.9%	68.4%
Went picnicking	64.0%	65.9%
Visited art or historical facilities	62.6%	61.2%
Went fishing	49.2%	48.6%
Bicycling for pleasure or exercise	44.9%	53.6%
Swam in a pool	44.6%	53.5%
Went boating/canoeing on river or lake	44.3%	47.1%
Used exercise equipment	43.0%	44.1%
Used a playground	42.8%	56.7%
Used undeveloped open space for activity	39.2%	38.9%
Played tennis	23.7%	29.2%
Played softball	23.7%	28.6%
Played golf	22.9%	16.6%
Played volleyball	20.8%	27.5%
Played basketball outdoors	20.0%	31.6%
Participated in outdoor nature program	19.6%	25.9%
Went bird watching	18.5%	16.9%
Played baseball	13.3%	23.2%
Played football	10.2%	19.0%
Went horse riding	10.0%	17.1%
Played soccer	4.6%	13.6%
Used facilities for handicapped people	2.6%	2.9%
Went skate boarding	2.1%	15.9%

MOTIVATIONS AND FACILITY PREFERENCES

Questions 6 and 7 in the questionnaire elicited respondents' ratings of preferred psychological outcomes (motivations) and preferences for different kinds of outdoor recreation facilities which could be included in planned bayou developments. The ratings responses were coded as follows for both of these questions:

1 = Very Important Motives, or
Very Necessary (Preferred) Facilities.

2 = Somewhat Important Motives, or
Somewhat Necessary (Preferred) Facilities.

3 = Neutral Motives, or
Neutral Facility Preferences.

4 = Somewhat Unimportant Motives, or
Somewhat Unnecessary (Not Preferred) Facilities.

5 = Very Unimportant Motives, or
Very Unnecessary (Not Preferred) Facilities.

Most of the 18 motive items included in question # 6 were selected from an item pool developed by Beverly Driver, a U.S.Forest Service recreation researcher at the Rocky Mountain Forest Experiment Station, and his associates. Items were selected which Driver had found to be quite important in other studies for the kinds of activities being considered for the recreational component of the Corps flood control plans. Driver has found that similar groups of motive items tend to be rated consistently high in importance for some of the same activities in different settings.

The 28 facility items included in question # 7 were selected on the basis of discussions held with the members of the Corps planning team during preliminary meetings held in the early phase of the study. Only facilities which would be feasible for the Corps to provide as part of the flood control plans were included in the list for question # 7.

The motivations and preferences ratings data were analyzed descriptively by first calculating means and standard deviations for each item. The means were then used to compile rank orderings of both the motives and the facility preference items. It is known that motives and preferences may vary by activity type. Therefore, respondents were asked to rate each motive and preference item with respect to the one type of activity package (of five given) for which the number of days of participation per person for their household was the highest. The five activity packages were picnicking, playground activities, trail activities, field sports, and undeveloped open space (activities). If two or more activities were tied for the most days of participation, respondents were

asked to base their ratings on the one of the five activity packages that they preferred the most. Motives and preferences were then ranked on the basis of mean ratings from respondents. Results of the ranking of motive and preference means were interpreted, respectively, in terms of the "bundles" of motives and preferences that were top ranked for each particular type of activity package. The results of this analysis for the motivation items from question # 6 in the questionnaire are presented in Table B-2. The results for the preference items from question # 7 in the questionnaire are shown in Table B-3.

Picnicking. For the picnicking activity package, the three top ranking motives shown in Table B-2 were: to have a change from your daily routine, to do something with your family, and to relax physically. Each had a mean of 1.4. The next highest ranking motives for picnicking were: to experience tranquility, to help release or reduce some built up tensions, and to be where things are fairly safe (each with means of 1.6). Next highest was: to be close to nature with a mean of 1.7, and to be away from crowds of people with a mean of 1.9. Each of these item means were below 2.0. This would indicate that, on the average, respondents considered each of these motives as more than somewhat important reasons for picnicking.

The three most preferred (necessary) facilities for picnicking were: restrooms, refuse dump (garbage) containers, and trees and natural vegetation (Table B-3). Each had a mean of 1.3. Picnic tables were also highly preferred, with a mean of 1.4. Next most preferred for picnicking (mean of 1.7) were: benches to sit on, trails for walking, grass/open turf areas, and water fountains. Next highest in preference (need) were information/route signs with a mean of 1.8, parking lot (mean of 1.9), and paved access roads (mean of 1.9). Each of these item means were below 2.0, indicating that, on the average, respondents considered each of these facilities as more than somewhat necessary for picnic area use.

Playground Use. For playground use the highest ranked motive was "to do something with your family", with a mean of 1.3 (Table B-2). Next highest was the motive "to experience tranquility", with a mean of 1.4. Next highest was "to be where things are fairly safe", with a mean of 1.6. Next highest were "to have a change from your daily routine", "to relax physically", and "to help release or reduce some built up tensions", each with means of 1.7. The next highest motive was "to get exercise", with a mean of 1.8. The means for these items were all below 2.0, indicating that Houston respondents, on the average, considered each to be more than somewhat important for using playgrounds.

Table B-2. Motives by Activity Package Participation.

Question #6: Motives for Activity Participation	PICNICKING	PLAYGROUND	TRAIL USE	FIELD SPORTS	OPEN SPACE
	Mean	Mean	Mean	Mean	Mean
To Have a Change from Your Daily Routine	1.4 (SD=0.71)	1.7 (SD=0.83)	1.7 (SD=0.91)	1.6 (SD=0.77)	1.5 (SD=0.79)
To Do Something with Your Family	1.4 (SD=0.85)	1.3 (SD=0.73)	2.2 (SD=1.21)	1.8 (SD=1.09)	1.7 (SD=0.96)
To Relax Physically	1.4 (SD=0.70)	1.7 (SD=0.91)	1.8 (SD=1.08)	1.9 (SD=1.08)	1.4 (SD=0.74)
To Experience Tranquility	1.6 (SD=0.85)	1.4 (SD=1.00)	1.6 (SD=0.97)	2.4 (SD=1.23)	1.5 (SD=0.78)
To Help Release or Reduce some Built up Tensions	1.6 (SD=0.92)	1.7 (SD=0.96)	1.6 (SD=0.94)	1.7 (SD=0.88)	1.6 (SD=0.81)
To Be Where Things Are Fairly Safe	1.6 (SD=0.92)	1.6 (SD=0.93)	1.8 (SD=1.05)	2.0 (SD=1.22)	2.0 (SD=1.07)
To Be Close to Nature	1.7 (SD=0.85)	2.0 (SD=1.07)	1.6 (SD=0.80)	2.6 (SD=1.21)	1.4 (SD=0.74)
To Be Away from Crowds of People	1.9 (SD=1.09)	2.1 (SD=1.02)	2.1 (SD=1.07)	2.5 (SD=1.27)	1.6 (SD=0.85)
To Experience New and Different Things	2.1 (SD=0.97)	2.1 (SD=1.08)	2.2 (SD=1.04)	2.5 (SD=1.17)	1.9 (SD=0.99)
To Get Exercise	2.2 (SD=1.04)	1.8 (SD=0.90)	1.4 (SD=0.71)	1.6 (SD=0.78)	2.0 (SD=1.02)
To Feel Your Independence	2.6 (SD=1.21)	2.6 (SD=1.20)	2.6 (SD=1.18)	2.6 (SD=1.15)	2.4 (SD=1.18)
To Get Over Feeling Depressed or Unhappy	2.6 (SD=1.31)	2.7 (SD=1.32)	2.6 (SD=1.31)	2.8 (SD=1.29)	2.6 (SD=1.26)
To Get Away from the Heat	2.7 (SD=1.15)	2.7 (SD=1.18)	3.0 (SD=1.23)	3.1 (SD=1.29)	2.8 (SD=1.20)
To Be Near Others Who Could Help If You Need Them	2.7 (SD=1.19)	2.6 (SD=1.12)	2.6 (SD=1.14)	2.8 (SD=1.13)	3.0 (SD=1.09)
To Feel isolated	3.1 (SD=1.25)	3.3 (SD=1.22)	3.1 (SD=1.28)	3.6 (SD=1.25)	2.8 (SD=1.28)
To Have Thrills	3.2 (SD=1.16)	3.1 (SD=1.19)	3.3 (SD=1.22)	2.7 (SD=1.15)	3.1 (SD=1.25)
To Improve Your Skills	3.2 (SD=1.21)	2.9 (SD=1.20)	2.7 (SD=1.14)	2.2 (SD=1.03)	2.6 (SD=1.16)
To Take Risks	4.1 (SD=1.09)	3.9 (SD=1.14)	4.0 (SD=1.12)	3.8 (SD=1.12)	3.8 (SD=1.13)

Table B-3. Facility Preferences by Activity Package Participation.

Question #7: Facility Preferences for Activities	PICNICKING	PLAYGROUND	TRAIL USE	FIELD SPORTS	OPEN SPACE
	Mean	Mean	Mean	Mean	Mean
Restrooms	1.3 (SD=0.65)	1.4 (SD=0.79)	1.7 (SD=0.94)	1.3 (SD=0.62)	1.6 (SD=1.02)
Refuse Dump (Garbage) Containers	1.3 (SD=0.76)	1.4 (SD=0.83)	1.9 (SD=1.21)	1.5 (SD=0.87)	1.6 (SD=1.00)
Trees and Natural Vegetation	1.3 (SD=0.65)	1.4 (SD=0.73)	1.3 (SD=0.68)	1.8 (SD=0.99)	1.3 (SD=0.61)
Picnic Tables	1.4 (SD=0.76)	1.7 (SD=0.91)	2.7 (SD=1.34)	2.4 (SD=1.23)	2.4 (SD=1.27)
Benches To Sit on	1.6 (SD=0.87)	1.6 (SD=0.81)	2.0 (SD=1.05)	1.8 (SD=0.93)	2.4 (SD=1.24)
Trails for Walking	1.7 (SD=0.88)	1.8 (SD=0.94)	1.3 (SD=0.79)	2.3 (SD=1.23)	1.8 (SD=0.98)
Grass/Open Turf Areas	1.7 (SD=0.82)	1.7 (SD=0.86)	1.9 (SD=1.05)	1.7 (SD=0.82)	1.9 (SD=1.08)
Water Fountains	1.7 (SD=0.97)	1.5 (SD=0.85)	1.9 (SD=1.08)	1.6 (SD=0.85)	2.2 (SD=1.27)
Information/Route Signs	1.8 (SD=0.99)	1.9 (SD=1.08)	2.0 (SD=1.10)	2.1 (SD=1.17)	2.0 (SD=1.08)
Parking Lot	1.9 (SD=1.03)	2.0 (SD=1.13)	2.0 (SD=1.16)	1.9 (SD=0.99)	2.4 (SD=1.29)
Paved Access Roads	1.9 (SD=1.05)	1.9 (SD=1.00)	2.1 (SD=1.16)	1.8 (SD=0.88)	2.4 (SD=1.32)
Flowers	2.0 (SD=1.01)	2.0 (SD=0.92)	2.0 (SD=1.00)	2.5 (SD=1.18)	2.0 (SD=1.05)
Nature Hiking Trails	2.0 (SD=0.97)	2.3 (SD=1.08)	1.6 (SD=0.95)	2.7 (SD=1.26)	2.0 (SD=1.13)
Grills or Barbecue Pits	2.1 (SD=1.08)	2.3 (SD=1.14)	3.1 (SD=1.30)	2.6 (SD=1.22)	2.6 (SD=1.27)
Night Lighting	2.1 (SD=1.24)	2.0 (SD=1.15)	2.2 (SD=1.27)	1.9 (SD=1.10)	2.6 (SD=1.37)
Facilities for Handicapped People	2.2 (SD=1.29)	2.3 (SD=1.30)	2.6 (SD=1.43)	2.6 (SD=1.44)	2.5 (SD=1.48)
Playground Equipment	2.3 (SD=1.21)	1.3 (SD=0.70)	3.2 (SD=1.30)	2.4 (SD=1.20)	2.8 (SD=1.24)
Jogging/Running Trails	2.3 (SD=1.20)	2.2 (SD=1.17)	1.6 (SD=1.03)	2.5 (SD=1.26)	2.5 (SD=1.35)
Fencing/Safety Fencing	2.3 (SD=1.18)	2.1 (SD=1.07)	2.6 (SD=1.20)	2.2 (SD=1.12)	2.6 (SD=1.12)
Bicycle Trails	2.5 (SD=1.13)	2.4 (SD=1.09)	2.1 (SD=1.21)	2.9 (SD=1.24)	2.7 (SD=1.28)
Canoe or Small Boat Facilities	2.6 (SD=1.13)	2.8 (SD=1.18)	3.0 (SD=1.33)	3.1 (SD=1.24)	2.4 (SD=1.11)
Gate Attendant	2.9 (SD=1.19)	3.3 (SD=1.22)	3.3 (SD=1.27)	3.3 (SD=1.19)	3.2 (SD=1.24)
Electrical Outlets	3.0 (SD=1.28)	3.1 (SD=1.27)	3.6 (SD=1.33)	3.2 (SD=1.24)	3.2 (SD=1.23)
Concessions	3.2 (SD=1.23)	3.2 (SD=1.20)	3.6 (SD=1.18)	2.8 (SD=1.18)	3.6 (SD=1.29)
Exercise/Fitness Equipment	3.3 (SD=1.17)	3.0 (SD=1.23)	3.0 (SD=1.34)	3.2 (SD=1.21)	3.6 (SD=1.21)
Skateboard Paths	3.6 (SD=1.18)	3.5 (SD=1.19)	3.8 (SD=1.21)	3.6 (SD=1.19)	3.7 (SD=1.16)

The most preferred (necessary) facility for playground use was playground equipment, with a mean of 1.3 (Table B-3). The three next most preferred facilities for playground use were: restrooms, refuse dump (garbage) containers, and trees and natural vegetation. Each had mean ratings of 1.4. The next most preferred facility for playground use was water fountains, with a mean of 1.5. Next most preferred were benches to sit on (mean of 1.6), picnic tables and grass/open turf areas, both with means of 1.7. Next were trails for walking (mean of 1.8), information/route signs (mean of 1.9), and paved access roads (mean of 1.9). These item means below 2.0 indicate that each of these facilities were considered more than somewhat necessary by Houston residents for their use of playground areas.

Trail Use. For trail use, the highest ranked motive was to get exercise, with a mean of 1.4 (Table B-2). Next highest in average importance for trail use were the motives to be close to nature, to experience tranquility, and to help reduce or release some built up tensions. All three had means of 1.6. Next highest in importance was the motive to have a change from your daily routine, with a mean of 1.7. Next highest in importance were the motives to relax physically and to be where things are fairly safe, both with means of 1.8. All these item means are below 2.0, indicating that these motives were more than somewhat important to respondents.

The most preferred (necessary) facilities for trail use were trees and natural vegetation and trails for walking, both with means of 1.3 (Table B-3). The next highest preferences were for nature hiking trails and jogging/running trails, both with means of 1.6. The next most preferred facility for trail use was restrooms, with a mean of 1.7. Next most preferred (necessary) facilities were refuse dump (garbage) containers, grass/open turf areas, and water fountains, each with a mean of 1.9. These mean values, below 2.0 for all of these items, indicate that Houston residents consider each to be more than somewhat necessary for trail use.

Field Sports. The most important motives, on the average for Houston residents participation in field sports were to get exercise and to have a change from your daily routine, both with means of 1.6 (Table B-2). Next most important was the motive to help release or reduce some built up tensions, with a mean of 1.7. Next most important were to do something with your family (mean of 1.8) and to relax physically (mean of 1.9). These item means below 2.0 indicate that these motives were each more than somewhat important as motives for Houston residents participation in field sports.

The most preferred (necessary) facility for field sports was rest rooms, with a mean of 1.3 (Table B-3). Next most preferred (necessary) was refuse dump (garbage) containers, with a mean of 1.5. Next most preferred for field sports were water fountains

(mean of 1.6) and grass/open turf areas (mean of 1.7). Next most preferred were trees and natural vegetation, benches to sit on, and paved access roads. Each had means of 1.8. Next most preferred were parking lot and night lighting, each with means of 1.9. These means below 2.0 indicate that the corresponding items were considered more than somewhat necessary by Houston residents for their participation in field sports.

Open Space. The most important motives for Houston residents use of undeveloped open space were to relax physically and to be close to nature, both with mean ratings of 1.4 (Table B-2). Next most important motives for use of undeveloped open space were to have a change from your daily routine and to experience tranquility, both with mean ratings of 1.5. Next most important were the motives to help release or reduce some built up tensions and to be away from crowds of people, both with means of 1.6. Next most important were to do something with your family (mean of 1.7) and to experience new and different things (mean of 1.9). These means below 2.0 indicate the above items were all considered to be motives of more that somewhat importance for use of undeveloped open space.

The most preferred (necessary) attribute of undeveloped open space was trees and natural vegetation, with a mean of 1.3 (Table B-3). Next most preferred were restrooms and refuse dump (garbage) containers, both with mean ratings of 1.6. Next most preferred (necessary) were trails for walking (mean of 1.8) and grass/open turf areas (mean of 1.9). These means below 2.0 indicate that, on the average, the above items were considered more that somewhat important by Houston residents for use of undeveloped open space areas.

OTHER FACILITY PREFERENCES

In addition to the 26 different kinds of facilities, respondents were asked to rate in terms of preference (necessity), question #7 also allowed respondents to write in "other" types of facilities and services not included in our list. The different kinds of "other" necessary facilities specified by respondents for each of the five types of activity packages are presented in Tables B-4 to B-8. The "other" preference response given most frequently for each of the five activity packages was some form of security or police protection. The "other" preference listed either second, third, or fourth most often for each of the five activity packages was for cleanliness and/or maintenance of facilities.

Table B-4. Other Picnicking Facilities Needed.

Number of Times Mentioned	Facility Type
24	Security; vehicle security; police patrol;law protection.
11	Neatness; cleanliness of grounds/restrooms
7	Shelters for changing clothes; out of rain & sun; Covered tables; pavilion
4	Shaded areas; Shade trees
4	Emergency phones; phones
4	Peace; low noise; prohibit radios/noise
3	Preventing crowding; crowd control
3	Accessible w/minimum traffic; traffic control
3	Safety fencing; safety
3	warning signs; brochures; maps; information
3	Family camping; safe camping facilities; tent camping areas
3	First aide; rescue services
3	Nature photography both plants & animals; ducks
2	Small pond/lake
2	Somewhat landscaped; # of flowers to trees
1	Mosquito control
1	Sport fields
1	Gun range
1	Sanded safe swimming areas
1	White water river canoeing w/livery service
1	Good boat ramps
1	Places closer to home
1	Fountains
1	Sculptures
1	Prohibit off-road vehicles
1	Prohibit guns
1	Lectures/programs
1	Ability to drink beer
1	Few pets
1	Water outlets
1	Handicapped Facilities
1	First aid facilities
1	Inexpensive

Table B-5. Other Playground Facilities Needed.

Number of Times Mentioned	Facility Type
5	Police;Security; Night watch; Park rangers; Park patrol
5	Pools for swimming
4	Fishing pier/Stocking lakes; lighted fishing pier
3	Proper maintenance/upkeep
3	Basketball Courts
3	Clean areas
2	Phone booths; Phone
2	Playground equipment; safe playground equipment
2	First Aid Station
2	Water (bayou, ponds)
1	Covered swimming area
1	Traffic Noise
1	Life guards
1	Reservation system for facilities
1	Golf/Tennis Courts
1	Safety crosswalk
1	Kite Flying areas
1	Well maintained drinking fountains
1	Areas for swimming in a lake
1	Pavilions
1	Camping facilities
1	Natural Bodies of water
1	Clean restrooms
1	Shade Trees
1	Trees for shade
1	Some undeveloped parks

Table B-6. Other Trail Facilities Needed.

Number of Times Mentioned	Facility Type
9	Security; vehicle security; police patrol;law protection; Crime control
2	Telephones/maps
2	Clean areas
2	Quiet area/ no children/ no pets
1	Club facilities, exhibition educational facilities
1	Areas where children will not get hurt
1	More lakes
1	More flowers
1	Showers/boar/canoe/rentals
1	Bike paths
1	Names of trees & Vegetation
1	Good running surface
1	Fishing Piers
1	Shelters for camping
1	Wilderness areas
1	Wild game
1	Trees
1	Well maintained areas
1	Clean ponds
1	Telephones on trails
1	Motorcycle trails
1	Wildlife safety
1	Equal public access
1	Horseback riding trails
1	Uncommercialized beach with few people
1	Strict anti-littering enforcement
1	Traffic Control
1	Regular control of poison hazards, ivy, stinging insects
1	Par course trails
1	Grass cut on routine basis
1	Natural environment
1	Weather shelters
1	Paths in good condition
1	Walk bridges over ravines
1	Tennis areas

Table B-7. Other Field Sports Facilities Needed.

Number of Times Mentioned	Facility Type
18	Security patrols; Police;
6	Clean area; Well maintained area
5	Soccer facilities
5	Basketball facilities
4	Clean swimming area; Public Swimming pool
4	Tennis courts; Tennis court maintenance
3	Telephones; Public phone
3	Water area; Water front area
2	Concessions; Food places
2	Group shelter; A place to get out of the rain
2	Room to spread; Open space areas
1	Attendance
1	Custodian
1	First aid station
1	Backstops
1	Fishing pier; Boat docking facilities
1	Pest control; Mosquitoes
1	Shelter area; to get out of the rain
1	Bicycle/walking/jogging trails
1	Golf course
1	Clean water
1	Signs
1	Fishing area
1	Baby sitting

Table B-8. Other Undeveloped Open Space Facilities Needed.

Number of Times Mentioned	Facility Type
6	Security patrol; Safety; Law enforcement
2	Clean area; Well maintained area
2	Boat ramps/improved boat ramps
2	Fishing pier
2	Natural area/left alone
2	Clean water
2	Fishing area; Suitable area for fishing
1	Small church
1	Proper supervisors/guides
1	Easy access
1	Road Signs
1	Horseback riding areas
1	Water area; natural waterways
1	Swimming area
1	Information center with guides
1	Free or reasonable price for families
1	Camping areas
1	Small lake for canoeing
1	Fish stocking programs